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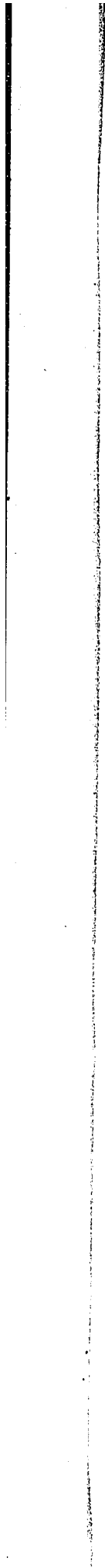
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**A CONTINUATION OF THE SEARCH FOR  
OBJECTIVE GRAPHOLOGICAL HYPOTHESES**

by **Wilburn Raymond Mann**

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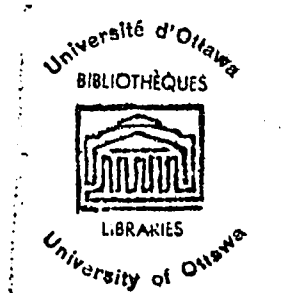
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**Thesis presented to the School of  
Psychology and Education of the  
University of Ottawa as partial  
fulfillment of the requirements  
for the degree of Doctor of  
Philosophy**



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Financial assistance and critical comment were also received from Clarence A. Tripp, Ph. D., Director, The Handwriting Institute, Incorporated, New York, New York.

## CURRICULUM STUDIORUM

Wilburn Raymond Mann was born on March 30, 1925 at Moorcroft, Wyoming. He received the Bachelor of Arts degree from the University of Texas in June, 1947. He received the Master of Arts degree in psychology and education from the Catholic University of America in June, 1953. His master's thesis was entitled, A Factor Analytic Study of Psychopathology.

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## INTRODUCTION

There has been much interest and speculation about what factors, if any, might be revealed about the personality and behavior of a writer in the individualistic qualities of his writing. There has grown up a body of assertions about relationships between handwriting and personality. Some of these are purely speculative, others empirical, based on observations of how handwriting changes with different personalities and at different stages in the life of a single personality. These efforts have been rather fruitful in spite of the complexity of the problems involving the handwriting as well as those involving the personality itself. The body of graphological theory, which began with the work of Klages, was influenced by Robert Saudek, and further developed more recently by Lewinson and Zubin, seems to hold the support of most serious students abroad and in North America. Students in this tradition have made progress in the development of graphological rationale and script measurement and analysis methods, qualitative and quantitative. On the side of personality traits, many factor analytic studies have been made. From this area of research, the Sixteen Personality Factor Questionnaire of R. B. Cattell and Associates has been selected for this study. This study sought to bring together some of the elements of these two strains of research, to study some of the relationships between personality traits measured by questionnaire and objectively measured handwriting traits as a continuation of the search for objective and empirical graphological hypotheses.

The objectives of the study have been broad rather than deep. The Cattell Questionnaire measures sixteen personality traits, and even by using two forms of the test, as was done here, only a few minutes - only a few questions per factor - were possible. A broad study of many factors rather than an intensive study of one or a few factors seemed desirable for two reasons. First, was the fundamental assertion by graphologists in the Klages tradition that prediction of personality traits must be made from the whole gestalt or pattern of the handwriting being analysed. Second, it was assumed that studying a broad span of personality traits might lead to a more adequate set of hypotheses for more intensive work on the prediction of individual personality factors.

Research into the predictability of personality traits from handwriting still seeks to come to grips with the problem in the sense that the general rationale of graphology developed by Klages has not yet been tested. No student of the problem has been able to develop a sufficiently wide experimental design to test the whole rationale. Probably even more basic is the lack of statistical procedures to adequately handle the demands of the problem. Klages insisted, as do the followers of his school today, that a specimen must be handled as a whole, as a configuration, in which particular individual handwriting qualities of slant, size, spacing, unique shaping of letter forms, etc., have relatively little meaning individually, but gain meaning in relationship to each other in the context of a particular handwriting. He asserted that these relationships are so complex that they can only be approached intuitively. Klages' theory has been criticised

as unscientific because as yet it has proven untestable.

As will be seen in the review of the literature there have been two series of empirical approaches to the problem, the *matching studies* and the *trait studies*. Both of these have yielded some evidence that personality traits can be predicted from handwriting. The present study was a trait study which sought to clarify which of twenty-five objectively measured handwriting traits considered individually or in combination are predictive of sixteen factored personality traits. The experimental design here also provided evidence concerning the stability of the personality traits studied over a five week interval. This information in turn was used to good advantage graphologically, in that it permits a beginning to be made toward asserting which personality traits when predicted from handwriting should be regarded as relatively stable and unchanging and which traits are relatively unstable and consequently may be predictable for only relatively short periods of time.

Like the prior trait studies to be surveyed in Chapter I this study has primarily sought to build the empirical evidence for the relationship of particular handwriting traits to particular personality traits. It has been an exploratory study, as have been the others, too, in that no hypotheses have been stated in advance, save the perfectly general null hypothesis that no relationship exists between handwriting and personality traits as measured, and for the population sampled.

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The study indicated, however, that this general null hypothesis should not be affirmed. Positive hypotheses concerning the relationship of combinations of handwriting traits for all sixteen of the personality traits studied were asserted.

## CHAPTER I

### BACKGROUND OF THE STUDY

#### 1. The Matching Studies, Their Contribution and Their Deficiency.

There has been gradual improvement in methodology in the scientific study of script-personality relationships, as has been shown in the thorough and careful review of the literature up to 1946 by Bell.<sup>1</sup> During the period reviewed by Bell, the development of the matching method was regarded as a step forward. In the matching method personality descriptions were drawn up by psychologists using a variety of methods and instruments. Handwriting specimens were obtained from the subjects used in the experiment. The specimens were then analysed by graphologists. Then the graphologists were asked to pair the descriptions provided by psychologists with the scripts. The graphologists proceeded in their analyses in their own way, following the particular graphological methods familiar to them according to their training and experience. Although these studies were quite consistently positive and tended to indicate a relationship between script and personality, they left an unfortunate division between psychological and graphological rationale which badly needs breaking down.

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<sup>1</sup> John Elderkin Bell, Projective Techniques, New York, Longmans, Green, 1948, p. 291-327.

The basic necessity for this type of approach, it was asserted, lay in the fundamental assertions of Klages' holistic graphology, as it is often called, that no single script trait could be interpreted outside of the context in which it was found. On this assumption, and there being, perhaps, nearly as many contexts as scripts, no clear-cut method of analysis relating single traits to context could be derived. It was asserted that the graphologist must proceed by intuition and knowledge derived through experience. That holistic graphology has been developed into high clinical skill is indicated in the work of Wolff<sup>2</sup>, Roman<sup>3</sup>, Lewinson<sup>4</sup>, and Sonneman<sup>5</sup>, to mention but a few of the leaders. But the basic assertion of Klages' holistic graphology, that the interpretation of any specific trait (degree of slant, size of the capital letters, distance between the words,

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<sup>2</sup> Werner Wolff, The Expression of Personality, New York, Harper, 1943, p. xiv-334, and Diagrams of the Unconscious, Handwriting and Personality in Measurement, New York, Grune and Stratton, 1949, p. xiv-423.

<sup>3</sup> Klara G. Roman, Handwriting, A Key to Personality, New York, Pantheon Books, 1952, p. xiv-382.

<sup>4</sup> Thea S. Lewinson, "Dynamic Disturbances in the Handwriting of Psychotics, with Reference to Schizophrenic, Paranoid, and Manic-Depressive Psychoses", in American Journal of Psychiatry, Vol. 97, 1940, p. 102-135 and R. L. Monroe, T. S. Lewinson, and T. Schmidl-Waehner, "A Comparison of Three Projective Methods", in Character and Personality, Vol. 13, 1944, p. 1-21.

<sup>5</sup> Ulrich Sonnemann, Handwriting Analysis as a Psychodiagnostic Tool, New York, Grune and Stratton, 1950, p. x - 276.

etc.) must be made intuitively in its relationship to the context of the other traits of a particular script, is a singularly difficult hypothesis to put to direct experimental test.

## 2. The Most Important Trait Studies.

In the view of the present writer, who first became interested in handwriting analysis via the intuitive works of the holistic graphologists, the problem of setting up experimental designs for testing graphological rationale has not been adequately approached to date. Something has always been lost. The matching method has tended to support the very general hypothesis that graphological predictions of personality traits do have validity, in that they agree sometimes even strikingly with predictions made by psychological tests and personality ratings, as has been shown by studies summarized by Bell<sup>6</sup>, and by Allport and Vernon<sup>7</sup>. These studies have given us, however, little or no help in understanding just how personality is reflected in handwriting and certainly much less in understanding why.

Consequently the writer has sought to follow the method of trait studies, that is, studies which attempt to find specific statistical relationships between

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<sup>6</sup> John Elderkin Bell, Projective Techniques, New York, Longmans, Green, p. 291 - 327.

<sup>7</sup> G. W. Allport, and P. E. Vernon, Studies in Expressive Movement, New York, Macmillan, 1933, p. xiii - 269.

handwriting traits objectively measured and personality traits also measured as objectively as possible. The present study resembles most those of Land, Pascal, Birge and McNeil and Blum which will be outlined shortly and commented upon. These studies have produced mostly positive results and have defined both handwriting trait and personality trait measurement procedures very explicitly. Before taking this step, however, the study of Castelnuovo-Tedesco will be briefly considered. Although it contributed to the design of this experiment, it was chiefly in the matching tradition discussed above.

Castelnuovo-Tedesco's<sup>8</sup> study came in 1948. It indicated that for his six handwriting judges spontaneous handwriting specimens were more revealing of personality traits than "copy" specimens in which subjects knew that their handwriting would be analysed. While the criterion personality traits of intelligence, originality, anxiety, compulsiveness, physical sex and masculinity were measured by standardized tests and Multiple Choice Group Rorschach Test, handwriting ratings of these variables were made on a holistic basis. That is, specific measurements were not made of handwriting traits, but the judges rated each specimen for the degree that it appeared to them to reflect its writer's personality traits, once before training, and once later after having studied three

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<sup>8</sup> Peter Castelnuovo-Tedesco, "A study of the Relationship between Handwriting and Personality Variables", in Genetic Psychology Monographs, Vol. 37, 1948, p. 167-270.

references in graphological analysis. Their second ratings of the handwriting specimens were more reliable and valid than their first. In the latter case contingency coefficients between the handwriting ratings and objective test scores were significant at the one percent level of confidence for intelligence, anxiety, compulsiveness and masculinity.

Castelnuovo-Tedesco showed that, for the best analytical results, it is necessary for the writing to be done under spontaneous conditions precluding knowledge on the part of the subjects that their writing would be analysed. This finding influenced the writer to set up similar controls as will be seen later in the chapter on procedure. Castelnuovo-Tedesco's study was an excellent example in the matching tradition. It pointed again to the need for studying the problem with more objective measures of handwriting traits in the hope that analysis might be made more objective and the relationship of personality to handwriting traits more clearly understood. The following five studies have made some progress in this direction.

The major trait studies in which both handwriting traits and personality traits have been very explicitly defined will now be discussed.

Land<sup>9</sup> found that persons with either extreme backhand or descending writing lines were more emotional, with the Pressey X-O as the personality

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<sup>9</sup> A. H. Land, "Graphology, a Psychological Analysis", in University of Buffalo Studies, Vol. 3, 1924, p. 81-114.

criterion, than controls who were either forehanded or who wrote with ascending writing lines.

In two studies Pascal<sup>10</sup> correlated handwriting traits and personality traits. The handwriting traits were objectively measured, the personality traits derived from ratings by staff psychologists at Harvard University where the study was made. Subjects in his experiments were twenty-two Harvard graduates. In the first of these studies four handwriting pressure variables were measured by a device developed in the Harvard laboratory and five personality variables were measured by ratings by Harvard psychologists according to definitions by Murray<sup>11</sup>. These variables were intercorrelated. Of the twenty correlations resulting, five were found significant at or beyond the five percent level. One such correlation could be expected out of the twenty on a chance basis. Also in this study Pascal reported three multiple correlations significant at the one percent level and three significant at the five percent level.

In the second of the studies the twenty subjects were rated on thirty-six traits defined by Murray and thirty-nine handwriting traits were measured

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<sup>10</sup> Gerald R. Pascal, "Handwriting Pressure: Its Measurement and Significance", in Character and Personality, Vol. 11, 1943, p. 235-254, and "The Analysis of Handwriting: A Test of Significance", in Character and Personality, Vol. 12, 1943, p. 123-144.

<sup>11</sup> Henry A. Murray, Explorations in Personality, New York, Oxford University Press, 1938, p. xiv-761.

including several ratios. Here nine first order correlations and nine multiple correlations were reported, significant at the one percent level. Pascal did not set himself the task of relating his findings to prior graphological theory or research, except that he utilized many operational definitions of handwriting traits published by Lewinson and Zubin<sup>12</sup>. Nor did he draw together his own results theoretically. His purpose was to indicate that statistically significant correlations between handwriting and personality traits beyond chance expectancy exist. He regarded his work as "starting from scratch" so to speak, although he did recognize the further need to relate experimental results with the rationale of graphology, especially that of the Klages school.

McNeill and Blum<sup>13</sup> began their study with a survey of some studies which were conducted previously by others and which they felt represented inadequacies of various kinds in research design. They did not completely survey the literature, but most of their criticisms of prior research were well taken. In their opinion the most glaring shortcomings to be found in one or more of the studies they surveyed were, ". . . failure to consider consistency of an individual's handwriting and reliability of raters' judgments, lack of specificity of

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<sup>12</sup> Thea S. Lewinson and Joseph Zubin, Handwriting Analysis, New York, King's Crown Press, 1942, p. xiii-147.

<sup>13</sup> Elton B. McNeill and Gerald S. Blum, "Handwriting and Psychosexual Dimensions of Personality", in Journal of Projective Techniques, Vol. 16, 1952, p. 476-484.

criteria used to evaluate handwriting; inadequacies of the global matching methods and dubious characteristics of some of the personality variables." In their study McNeil and Blum sought to take these shortcomings into account to produce a more adequate experimental design. Their methodology, consequently, was a great improvement over that of many earlier studies. They did, however, rate the specific handwriting signs they utilized instead of measuring them as was done in this study. In their study of interjudge reliability of ratings they found an average of ninety percent agreement with a range of from seventy to one hundred percent for seven variables figuring most prominently as predictors of the personality variables studied. They found in a consistency study of handwritings of a sample of forty subjects retested after a month's time an average intrajudge agreement of eighty-two percent and a range of from sixty-three to ninety percent for nine variables.

The personality variables studied by McNeil and Blum were those measured by the Blacky Pictures, a modified projective technique designed to measure the major dimensions of psycho-sexual development and object-relationships in psychoanalytic theory. Subjects in the experiment were 119 male undergraduates at Stanford University. They found seventeen significant relationships at the five percent level or higher using chi-square technique. While their paper included some discussion of theory, they stated, "Pending cross-validation done on another group of subjects, we prefer to delay attempts

to explain each of the individual findings, though some explanations will readily come to the reader's mind. These experimental data are presented here solely for the purpose of illustrating the fact that specific handwriting signs may well be found to correlate with personality dimensions<sup>14</sup>." This probably represents one of the strongest statements for the trait approach to experimental graphology yet published. While the results of McNeil and Blum are more encouraging than any published to date, they have not yet been cross-validated.

The final study of importance made was that of Birge<sup>15</sup>. Birge studied twenty-two handwriting traits and ratios defined again primarily by Lewinson and Zubin. He sought to show significant differences between the means of handwriting measurements of groups of subjects chosen as highest and lowest in their fraternities or sororities for five personality traits: intelligence, emotional stability, dominance, cultured mind and high strung temperament - by their fellow members. He found that subjects were selected highest by their fellows in the fraternities and sororities with from .73 to .96 in reliability. Subjects selected as lowest, however, were selected much less reliably, with coefficients for the five traits going from .32 to .81. The two highest and two

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14 Ibid., p. 482.

15 W. R. Birge, "An Experimental Inquiry into the Measurable Handwriting Correlates of Five Personality Traits", in Journal of Personality, Vol. 23, 1954, p. 215-223.

lowest subjects were selected from each of fourteen fraternity and sorority groups, making groups of twenty-eight subjects in each. A further variable, intelligence by ACEPE score, was studied again by choosing the two highest and the two lowest subjects in each fraternity and sorority group.

Birge found ten significant differences between the means of the handwriting trait measurements of subjects making up the groups just described at the five percent level and one difference at the one percent level. He did not accept this as sufficient evidence for refutation of his general null hypothesis, however, since he believed that this number of differences out of 132 calculated could be expected on a chance basis alone. He reported negative findings, then, for the primary objective of his study which was to establish satisfactory evidence of differences between means of measured handwriting traits for his groups of high and low subjects in the traits studied. He did, however, report very satisfactory reliability figures for the objective handwriting traits measured.

It is to be noted that here, as with Pascal previously, no attempt was made to make hypotheses from theory or rationale. Only a general null hypothesis was made covering all differences between means studied.

No objection can be made to Birge's general experimental or statistical approach to the problem, but it is possible that he accepted the null hypothesis too readily. He points out in his conclusions that despite his declared negative results on a pure trait basis, continued trait studies should be made, especially utilizing methods allowing for sign interaction. It is an open question as to what

multiple correlation analysis of Birge's data might have revealed.

The four studies reviewed above have indicated that the trait approach to the problems of graphology is feasible. At the same time all of these writers have affirmed that this approach may not do complete justice to the Klages system of holistic graphology. However, since, short of the matching method, there seems little prospect of approaching the holistic rationale statistically, it is regarded as desirable to continue trait study with the prospect that slowly a body of evidence will build up which will permit increasingly refined and perhaps even more sophisticated objective hypotheses.

### 3. The Personality Test Used.

There has also been continued progress in the factor analytic study of personality variables measured by questionnaires at the hands of R. B. Cattell and his associates. That all obstacles here have not yet been overcome is acknowledged by Cattell<sup>16</sup>, but that considerable progress has been made is pretty generally recognized. One key to further progress probably lies in the development of objective measures of personality traits. This idea has helped to prompt the present efforts and the handwriting measurements used here are objective.

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<sup>16</sup> Raymond B. Cattell, Personality and Motivation Structure and Measurement, New York, World Book, 1957, Chapter 6.

J. P. Guilford and W. S. Zimmerman<sup>17</sup> have also developed an outstanding instrument, but the writer finds the position of Cattell on simple structure and oblique vs. orthogonal rotation more acceptable than that of Guilford. Cattell has also operated on a wider basis of personality research and has shown that twelve of the questionnaire factors used in the study duplicate factors derived from intensive prior study of personality by rating of life behavior. Further, the tests used in this study are the results of a second major revision of the original questionnaire and a double blind rotation to oblique simple structure of the newly developed and intensified data. Nevertheless, though the Cattell 16 Personality Factor Questionnaire is regarded by this writer as the most promising test of its kind for the measurement of a wide variety of personality factors, it represents but one strain of personality research. It has not yet been generally accepted as a standard for either research or clinical measurement of personality variables. Personality factors derived by Cattell, by Guilford, by Thurstone, by Eysenck or others who have sought to clarify the dimensions of personality by factor methods are not yet fully understood by their discoverers.

In the interest of defining terms it seems advisable to set down the personality variables measured by the Cattell test and a brief definition of each:

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<sup>17</sup> J. P. Guilford and W. S. Zimmerman, The Guilford-Zimmerman Temperament Survey: Manual of Instructions and Interpretations. Beverly Hills, California, Sheridan Supply Co., 1949.

**Factor A-Cyclothymia vs. Schizothymia.**

The cyclothymic individual tends to be goodnatured, easy going, attentive to people, and cooperative, while the schizothymic person tends to be obstructive, critical, rigid, precise and socially cold and aloof.

**Factor B-General Intelligence vs. Mental Defect.**

This is a brief power measure of the g-factor.

**Factor C-Ego Strength vs. Ego Weakness.**

This factor measures the degree of ego strength of an individual probably very much in the sense that ego strength is understood in psychoanalytic theory. A person of high ego strength tends to be emotionally stable and mature, realistic about life and high in frustration tolerance, while the person of weak ego tends to have difficulty in tolerating frustration and suffers from emotional instability.

**Factor E-Dominance vs. Submission.**

This is the trait previously studied by Allport and others. The dominant individual tends to be assertive and self-assured. Not exactly the same manifestations of this trait are seen in both sexes. In women dominance often takes the form of hypochondriasis, social poise, prominence and attention-getting in the

place of the more forthright self-assurance and aggression of males.

**Factor F- Surgency vs. Desurgency.**

The surgent individual tends to be enthusiastic, cheerful and talkative while the desurgent individual tends to be depressed, sober and laconic.

**Factor G- Superego Strength vs. Superego Weakness.**

Again the variable measured here is very similar to the quality of super ego strength as defined in psychoanalytic theory. A person of strong super ego is conscientious, responsible and persistent, while a person weak in superego tends to be casual, undependable and irresponsible. The guilt proneness often associated with a strong superego is not so much present as the variable is measured in the Cattell Test. This aspect of super ego appears to have broken off so to speak in factor analysis and shows up more in Factor O, which is defined below.

**Factor H- Parmia vs. Threctia.**

A parmian individual tends to be bold, adventurous and thick skinned, while a threctic person tends to be shy, timid and withdrawn. The new terms coined by Cattell here refer to what Cattell regards as the more basic meaning of this variable. This appears to be the most highly inherited of all the traits

according to Cattell. A parmic individual has a more stable autonomic nervous system, whereas, the threctic person has a more unstable autonomic nervous system according to Cattell.

**Factor I- Premisia vs. Harria.**

This dimension of personality is the same as that called toughminded-tenderminded by William James. That is, a premisic person tends to be sensitive, esthetic, tenderminded and intuitive, while an harric individual tends to be more toughminded, realistic (even cynical in the extreme) and looks to facts and logic in seeking answers to problems.

**Factor L- Protension vs. Relaxed Security.**

The protensive individual tends to be jealous, suspicious and brooding while the person scoring low in Factor L tends to be trustful, open and accepting. Cattell indicates that there is some similarity between protension and paranoia, but the former lacks the delusions of persecution and grandeur of the abnormal condition.

**Factor M- Autia vs. Praxernia.**

The autistic person is described as imaginative, self absorbed, absent minded and impractical while the praxernic individual is practical minded, alert

to stimuli from without himself, and generally more conventional.

**Factor N- Shrewdness vs. Naivete.**

The shrewd person is described as having a socially alert mind, being insightful into his own motives and those of others while the naive person is lacking in insight and is socially clumsy.

**Factor O- Guilt Proneness vs. Confident Adequacy.**

The guilt prone individual is inclined to worry, feel more guilty than the average, suffers a lot from anxiety and neurasthenia and has little self confidence while the confidently adequate person does not take himself very seriously, is more generally confident and tends to resolve problems by activity rather than by worrying.

**Factor Q<sub>1</sub>- Radicalism vs. Conservatism of Temperament.**

The radical individual tends to be better informed, more inclined to experiment with problem- solutions, question the surface appearance of things and get to the root of problems; while the conservative person tends to accept the status quo and is not searching in thought.

**Factor Q<sub>2</sub>- Self Sufficiency vs. Group Dependency.**

The self sufficient person is one who is accustomed to thinking and acting alone and generally enjoys lonely pursuits. The group dependent person is uncomfortable away from company, enjoys work and pleasure which involve cooperation with people.

**Factor Q<sub>3</sub>- High Self-Sentiment Formation vs. Poor Self-Sentiment Formation.**

This dimension represents the degree to which a person has developed for himself a clear, consistent pattern of action leading to goals which are regarded as worthwhile to the person if not to society. It is often referred to as will control and probably represents closely this important common sense quality of character formation and control.

**Factor Q<sub>4</sub>- High Ergic Tension vs. Low Ergic Tension.**

The best general interpretation of this factor, according to Cattell, is that it represents a level of excitement and tension, of undischarged and partly uncontrollable libido.

The foregoing is a brief survey of the dimensions of personality measured by the Cattell test. No attempt will be made here to define the higher order factors of introversion-extroversion, general anxiety, etc., which Cattell has

found. The study of the prediction of higher order personality factors from handwriting traits must wait for other research. Although these may contribute greatly to an eventual general graphological rationale, the concern of this work has been with handwriting traits predictive of the first order traits described above. In the view of the writer graphological rationale ought to grow with objective personality research and a general rationale probably will not be possible before there is an objective theory of personality.

#### 4. The Status Quo of Handwriting-Personality Research.

The reader has already seen that graphological research has proceeded by the matching method and via trait studies. The writer has pointed out that the intuitive general rationale of Klages' holistic graphology has not yet been adequately tested. Further indication of this is to be seen in the very careful review of the literature in graphology from 1933 to 1960 by Fluckiger, Tripp and Weinberg<sup>18</sup>. These writers point out that a considerable amount of investigation has been done on the relationship of measurable handwriting traits to personality dimensions. But many qualities of handwriting (for example, especially, the formniveau of Klages, or form level, because it is not measurable) have not been studied.

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18 F. A. Fluckiger, C. A. Tripp and George H. Weinberg, "A Review of Experimental Research in Graphology, 1933-1960", in Perceptual and Motor Skills, (Monograph Supplement 1-V12), Vol. 12, 1961, p. 87-90.

However, form level in the Klages' system is of paramount importance since it draws together, so to speak, or serves as a standard by which other handwriting traits are judged and even interpreted.

For the worker who desires to attack the problem of graphological research from a scientific standpoint there is a genuine dilemma: a scientific desire for strict communicable operational definition of both handwriting and personality traits and straightforward statistical procedure, and at the same time there is a remoteness, in a way, of these procedures, from the intuitive process of handwriting analysis itself.

Fluckiger, Tripp and Weinberg also point out that few graphologists attach specific interpretations to measurable traits of handwriting. However, they point out that a fairly sizable accumulation of correlations of measured handwriting traits with measured personality traits has grown up. One difficulty here, however, is that none of these studies has been repeated. In this paper the writer has surveyed briefly some of the most important and carefully conducted of these studies. But each of these has used a different set of personality criteria. The present study is no exception. The advantage of using the criteria selected here is that the Cattell appears to offer one of the most carefully constructed and most general surveys of personality traits, in the normal range, yet devised.

The study undertaken, then, by this writer is purely empirical. It can be repeated in whole or in part. But until it is, in the opinion of the writer, it should be regarded in more or less the same light as the prior studies of Pascal,

Land, Birge and McNeil and Blum, as another step in the slow accumulation of empirical data. A practical, objective graphology may be possible, although at this stage of research it appears rather distant.

#### 5. The Specific Objectives of This Study.

In this study a group of reliably measurable handwriting traits has been correlated with the sixteen personality traits measured, pair by pair, in all possible combinations. This has been an exploratory step. The objective here was to find which handwriting traits were predictive of which personality traits as far as possible within the scope of the measurements made. The stability of the Cattell traits was studied over a five week interval. This permitted an approach to the problem of which personality traits predictable from handwriting traits are most liable to fluctuation and which are more stable over the period studied. Finally, a further exploratory step was taken. The handwriting-personality variable correlations were studied by the method of multiple correlations. The objectives here were to try to find which of several handwriting predictors of personality traits in combination would join together to raise the overall accuracy of prediction, and which, if any, variables might function as suppressors and hence, too, increase the over-all accuracy of prediction.

The final result was sixteen unique combinations of handwriting traits predictive of the sixteen personality traits measured. Thus, sixteen objectively derived hypotheses were stated, far from demonstrated as unquestionably true,

but testable and expandable in further research.

The script measurement methods used in this study have come chiefly from Lewinson and Zubin<sup>19</sup> and Harvey<sup>20</sup>. The measures of loopiness, especially, were influenced by Harvey's paper. Most of the other measures were adopted from Lewinson and Zubin. Another important student of graphology was Robert Saudek<sup>21</sup> who was much interested in the implications of the speed of writing. He developed a series of criteria for judging the speed with which a specimen was written, though no objective measurements were taken. In the present study the speed of writing was objectively measured. The operations of measurement for the handwriting variables are in Chapter II.

No specific theoretical position is taken here apart from the commitments in personality implied from the adoption of the Cattell personality questionnaire and the seeking of methods as objective and reliable as possible for the measurement of the handwriting variables. Whether the intuitive trait-context hypotheses of holistic graphology can be replaced completely by the multiple

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19 Thea S. Lewinson and Joseph Zubin, Handwriting Analysis, New York, King's Crown Press, 1942, p. xiii-147.

20 O. L. Harvey, "The Measurement of Handwriting Considered as a Form of Expressive Movement", in Character and Personality, Vol. 2, 1934, p. 310-321.

21 Robert Saudek, The Psychology of Handwriting, New York, Morrow, 1926, p. vii-394.

regression equations remains to be seen. But that such equations are possible for personality variables measured and population sampled is the thesis of this paper.

## CHAPTER II

### EXPERIMENTAL PROCEDURE

#### 1. Obtaining a Spontaneous Handwriting Sample by a Disguised "Association Test".

This experiment was conducted as an exercise in a class in introductory psychology. Two full class periods at five week intervals and fifteen minutes of another half way between them were available. The experimenter wanted to provide the students in the class with experience in a questionnaire approach to the measurement of personality traits and with a brief word association experience. At the same time the experimenter was seeking data in order to study the relationship between personality traits measured by questionnaire and objectively measured handwriting traits. To utilize the opportunity available the following procedure was followed:

First, a test called the Context Based Association Test was constructed by the experimenter. Its purpose was to disguise the reason for obtaining a controlled handwriting specimen as an experiment in word association. As was pointed out in the introduction Castelnovo-Tedesco provided evidence that for the best analytical results handwriting specimens should be as spontaneous as possible and obtained in a fashion precluding the subjects' knowledge that the writing would be analysed. In the instructions the subjects were told that the test was

a variation of the word association tests which they had studied briefly. They were told that they would be asked to copy, word for word, a passage about a storm at sea for two minutes without hurrying particularly. The purpose of the writing, they were told, was to bring their thinking to the same "home base", so to speak, before the association words were given. This way their association to the words would begin in the same "context" - hence the name, "Context Based Association Test". Association words chosen were the forty-six words from the Kent-Rosanoff list which have the highest communality of response (to which Rosanoff and Kent's subjects responded with the highest frequency with but only a few other words). The experimenter was interested in both the writing and the word association data, but for the purpose of the present study the association data was laid aside and only the handwriting data studied.

Apparently the use of the "Context Based Association Test" as a ruse to disguise the purpose of the handwriting sample succeeded quite well, for though many subjects asked later about the association words, no subject asked about the handwriting part. The time of writing was controlled at two minutes so that a measure of the speed of writing (or one might say, "productiveness of writing" since subjects were tested in groups and it was not possible to be sure that every subject wrote continuously during the two minutes) could be made.

## 2. Sampling and Other Controls

The subjects were issued identical writing paper and pencils. The pencils were the very common "Scripto" brand mechanical pencils all loaded with the same lead (I. B. M. E650 electrosensitive). These pencils were used because they were readily available and have been widely used by students at least in testing situations if not elsewhere. They required little or no accommodation by subjects to an unusual writing instrument. They appeared, then, to be a good choice to control variation due to writing instruments which has not been controlled in previous studies.

Two class periods five weeks apart were available for measurement of personality traits by questionnaire, as was pointed out above. Half of the students wrote Form A and half wrote Form B on the first testing and on the second testing the students wrote the opposite form. This provided information about the individual differences of the students on the sixteen personality traits measured. It also provided information on the test-retest reliability (or stability) of the traits for the five week period. For the discussion, the actual experimental figures and the definition of the experimental criteria see Chapter III.

All the students in the introductory class, both male and female, took the tests, but only the 110 male, righthanded students were used as subjects in this study, the other data having been layed aside.

### 3. Choice of Handwriting Variables for Study and Their Measurement

Handwriting variables have been broadly classified as follows:

- A. Signs: particular mannerisms of executing single letters (such as closed or unclosed a's or o's and oddities of i-dots or t-bars).
- B. Ratable characteristics of the handwriting as a whole (such as ornamentation-simplification of the letter forms and form level).
- C. Measurable characteristics of the handwriting as a whole, which are the subject of the present study.

Variables of the latter type are susceptible to operationally defined procedures of measurement or counting. These operations for the twenty-two basic variables of the study are quite simple, requiring only elementary facility with simple measuring devices: a metric ruler and a protractor. Linear measurements were made to the nearest half millimeter.

The directions for the operations performed for each of the handwriting traits are:

1. Speed of Writing: Count the total number of letters written by the subject and divide the result by 120 for letters per second written by the subject. (As seen above, this might also be called "productiveness").
2. Disconnectedness: Count the number of times the writer breaks the writing line within words, including any breaks between capital letters and lower case letters; divide the result by the total disconnections possible, assuming this to be one break between each letter, within the words, corrected for any omitted letters or words, and for abbreviations.
3. Width of the Top Border: Measure the distance vertically from the top edge of the paper to the uppermost point of the first word of the first line. Repeat for the last word of the first line. Average the measurements.
4. Paragraph Indenture: If the indenture of the first line exceeds that of the third line, paragraph indenture will be considered to have taken place. If this is

not the case, the measurement assigned will be zero. If there is indenture, measure its depth horizontally, taking the distance between the farthest left point of the first line and the farthest left point of the second line.

5. Left Border Width: Measure the horizontal distance from the left edge of the sheet to the farthest left point of each writing line (save the first); sum the measurements and take their average.
6. Right Border Width: Perform the same measurements as for the left border on the right side, this time however include the first line but ignore the last line.
7. Distance Between Lines: Measure the distance from the base line of the first line to the base line of the last complete line at the left side of the script. Repeat for the right side of the script. Average the two and divide by the number of spaces between the lines.
8. Word Distance: Begin with the farthest left point of the first word of the first line and measure to the last point at the right of the first line before any punctuation appears. Measure each word in the above interval and sum. Take the difference between the length of the interval before the first punctuation in the first line and the summed lengths of the words. Divide this difference by the number of spaces between words in the interval.
9. Word Distance Span: Examine the specimen as a whole for the largest and smallest spaces between consecutive words in which no punctuation mark appears (measuring as many spaces between words as necessary) and take the difference between them.
10. Distance Between the Letters: The word "see" appeared four times in the first two sentences copied by the subjects. Measure the average distance horizontally between the double e's at the points where they approach each other closest.
11. Width of the Letters: Measure the distance between the topmost points of the first five u's. Take the average.

For the following measurements place a tracing sheet over the specimen and fasten the sheets together with paper clips at the bottom of the sheet if the writing tends to cover most of the sheet.

12. Height of the Capital Letters: Examine the specimen and trace the base line of all the words which begin with a capital letter. Place a short, straight line through each capital letter in the direction of the slant of the writing at that point. Place a short line through the highest point of each capital letter which runs parallel to the base line of the word as nearly as possible. Measure the distance between the two points thus defined for each capital letter. Take their average.
13. Height of the Lower Zone: Beginning in the first line of the specimen, trace the base line of the first five words containing lower zone letters, excepting the letter p. Trace a line through the lowest point of these letters parallel to the base line about a quarter of an inch in length. Draw a line through the letter in the direction of the slant of the letter and measure five such lower zone letters through the points so defined. Get their average.
14. Slant of the Letters: Place a straight line through the beginning point and the end point of the base line of the last complete line. Place a straight line through the upper zone letters in this line with a ruler in the direction of the slant, extending the line upward to sufficient length for ready measurement of the angle of the slant, with a protractor, to the edge of the sheet if necessary, and downward in the same way for letters near the right end of the line. Measure counterclockwise so that a right slant will always be less than ninety degrees. Record the measurements as they are taken, sum them and average them.
15. Height of the Upper Zone Letters: Measure the height of the upper zone letters along the slant lines drawn above in the last complete writing line and sum them. Get their average.
16. Height of the Middle Zone: Trace the middle zone of the last complete line. Place short, straight lines through the narrowest and widest portions of the lower zone of each word in the direction of the slant at these points. Measure the distance between each of the pairs of points so defined and sum them. Get this average.
17. Inclination of the Writing Lines: Draw straight lines through the beginning base line point and the ending base line point of each complete line, extending them to the left edge of the sheet. Measure inclination in degrees from the horizontal, call them plus if they incline toward the top of the sheet and minus if they decline toward the bottom of the sheet. Get their average.
18. Span of Inclination: Take the angle between the most ascending and the most descending lines.

The following measurements are taken, again, directly from the specimen.

19. Total Loopiness: Count all the white spaces entirely surrounded by the writing line in all the words and divide by the total number of letters. (This means count all looped l's, t's, g's, y's, etc., - all loops appearing in any place.)

20. Upper Zone Loopiness: Count the number of white spaces entirely surrounded by the writing line in the upper zones of the upper zone letters and divide by the number of upper zone letters in the specimen.

21. Lower Zone Loopiness: Count the number of white spaces entirely surrounded by the writing line in the lower zones of the lower zone letters and divide by the number of lower zone letters.

22. Middle Zone Loopiness: Take the sum of the upper zone loops and the lower zone loops, subtract this from the total loops and divide by the total number of letters less the number of capital letters in the specimen.

Variables 23, 24 and 25 are simple arithmetical derivations of the above.

Many operations above were facilitated by prepared charts which were possible because the subjects all copied the same passage. The specimens had to be examined carefully first to determine whether directions had been followed. The directions to the subjects for the Context Based Association Test were apparently clear enough. The small number of misspellings, abbreviations and brief omissions were taken to indicate that the subjects were copying the passage, although in some cases fairly carelessly. The specimens gave every appearance of spontaneity. The subjects appeared to have looked upon the writing as relatively unimportant in itself, which was what was desired by the experimenter. (The prepared charts of the cumulative number of letters in the passage reckoned

## EXPERIMENTAL PROCEDURE

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word by word, the cumulative number of spaces between letters, etc., are available from the writer. Also available are complete instructions for the Context Based Association Test, material copied and association words used.)

## CHAPTER III

### THE BASIC STATISTICAL RESULTS

In this chapter the experimental reliabilities of the handwriting and the personality variables are reported and discussed. Since interesting information about the relative stability of the personality variables over the five week period which elapsed in the study came out, this is presented and discussed. The experimental criteria are defined and the implications of them for the study as a whole are explained. A note concerning the construct or concept validity of the personality traits follows. Tetrachoric correlations were run between all pairs of handwriting and personality variables. These are reported and discussed especially in relation to the specific character of the experimental reliabilities of the personality criteria variables. Finally, a table of intercorrelations of all the handwriting variables is presented and briefly interpreted to provide the remaining figures necessary for a multiple correlation analysis of the data of Chapter III. Chapter IV will also be found to be primarily statistical in character, consisting of a presentation of the exploratory multiple correlations found followed by a detailed outline of the procedures followed in obtaining them and the specific variables entering each. In Chapter V the contribution of the study to general graphological research, its implications for further research and the general conclusions will be set down.

### 1. Experimental Reliabilities of the Variables Studied.

#### A. The Handwriting Variables.

In Table I are listed the handwriting variables for which it has been possible to obtain satisfactory re-measurement reliability figures (product-moment correlations between the measurements obtained by the writer and independent remeasurements). Mrs. Josephine Fay, then a graduate student in psychology at Wayne State University, Detroit, Michigan, remeasured all the variables for the thirty specimens selected at random for the handwriting reliability study. Three other variables which are not listed in Table I were simple arithmetic derivatives from combinations of those listed. These are to be found in later tables, but their reliabilities were regarded as of the same order as the reliabilities of the variables from which they were derived. Similarly high reliability figures for handwriting traits have been reported by Birge<sup>22</sup>, McNeil and Blum<sup>23</sup>, and in the two studies by Pascal<sup>24</sup>. Only remeasurement

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<sup>22</sup> W. R. Birge, "An Experimental Inquiry into the Measurable Handwriting Correlates of Five Personality Traits", in Journal of Personality, Vol. 23, 1954, p. 215-223.

<sup>23</sup> Elton B. McNeil and Gerald S. Blum, "Handwriting and Psychosexual Dimensions of Personality", in Journal of Projective Techniques, Vol. 16, 1952, p. 476-484.

<sup>24</sup> Gerald R. Pascal, "Handwriting Pressure: Its Measurement and Significance", in Character and Personality, Vol. 11, 1943, p. 235-254 and "The Analysis of Handwriting: A Test of Significance", in Character and Personality, Vol. 12, 1943, p. 123-144.

Table I

**Basic Handwriting Variables and Their Remeasurement  
Reliabilities (N=30)**

|                              |      |                                  |     |
|------------------------------|------|----------------------------------|-----|
| 1. Speed of Writing          | 1.00 | 12. Capital Letter Height        | .98 |
| 2. Disconnectedness          | 1.00 | 13. Lower Zone Height            | .96 |
| 3. Width of Top Border       | .98  | 14. Slant of Letters             | .97 |
| 4. Paragraph Indenture       | .99  | 15. Height, Upper Zone Letters   | .92 |
| 5. Width of Left Border      | .98  | 16. Height, Middle Zone          | .83 |
| 6. Right Border Width        | .87  | 17. Inclination of Writing Lines | .94 |
| 7. Distance between Lines    | .99  | 18. Span of Inclination          | .90 |
| 8. Word Distance             | .93  | 19. Total Loopiness              | .96 |
| 9. Word Distance Span        | .95  | 20. Upper Zone Loopiness         | .97 |
| 10. Distance between Letters | .92  | 21. Lower Zone Loopiness         | .94 |
| 11. Width of Letters         | .86  | 22. Middle Zone Loopiness        | .90 |

reliability has been studied in the present paper.

Reliability in the sense of stability over a period of time for handwriting variables has received some attention. Probably the first of such figures are to be found in Harvey's study<sup>25</sup> in 1934. Harvey worked with specimens collected at an interval of two months, and under different conditions. He reported that the average correlation between the first and second specimen measurements was .77 for direct measurements and .71 for ratios. His correlations ranged from .4 to .8 despite the difference in the conditions under which the two sets of specimens were collected. It was also pointed out in the first chapter of this paper that McNeil and Blum<sup>26</sup> were interested in this problem. These writers found an average intra-judge consistency of eighty-two percent for specimens rated. Their specimens were collected a month apart. Both of these studies were made using college students as subjects as was true here. This tends to support statistically an observation which would concur with the experience of most readers of the writing of college students. It means that though a college student's handwriting may vary somewhat from time to time, especially under conditions of stress, the basic pattern of the writing has usually been pretty well set.

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25 O. L. Harvey, "The Measurement of Handwriting Considered as a Form of Expressive Movement", in Character and Personality, Vol. 2, 1934, p. 310-321.

26 Elton B. McNeil and Gerald S. Blum, op. cit., p. 481.

Reliability in the sense of internal consistency, or the stability of a trait in a specimen, has been studied chiefly through the calculation of the range (often called the span in graphological literature). This practice has been followed for two variables used in the present effort, and the two variables were found to enter multiple correlations, as will be reported in Chapter IV. Intra-specimen trait fluctuations, then, also require experimental study.

B. The Criteria Personality Variables.

i. The Selection and Definition of the Personality Criteria. - It was noted in Chapter II, Procedure, that the two forms of the Cattell test were administered with an intervening five week period. This being so, it was decided to choose as the experimental criteria for this study the sums of the raw scores of the two forms for each of the sixteen personality variables studied. Since correlational analysis of the data was planned, these sums really represented the same thing as the average of the two scores. Consequently the scores are those statistically typical of the subjects studied during the five week period.

ii. The Reliabilities of the Personality Criteria. - The five weeks which elapsed between the time the subjects took the first form of the test and the time they took the second form of the test provided some interesting indications about the relative stability of the personality traits studied over the period, but at the same time reduced the experimental reliabilities of the variables studied. Actually

two estimates of the experimental criteria reliabilities were made. These were the consistency coefficients for the two forms of the test administered as one battery to 450 young adult males and published in the manual by Cattell et al., and the stability coefficients calculated from the data collected in the present study. These were both product moment correlations corrected to full length by the Spearman-Brown formula. The two forms were assumed to be equivalent and the order in which they were administered was ignored. These consistency and stability coefficients are presented in Table II.

The best estimates for the experimental criteria reliabilities of the personality measurements taken in the present experiment were regarded as the stability coefficients presented in Table II. As experimental reliability estimates, the stability coefficients left quite a bit to be desired in the sense that they reduced the correlations obtained between the handwriting and personality variables. But to the degree that they instruct research workers about the variability of these personality factors over time, they are helpful both psychologically and graphologically. They tend to indicate that Factors A (Cyclothymia), E (Dominance), F (Surgency), M (Autia), O (Guilt Proneness or Timidity) and Q<sub>4</sub> (Ergic Tension) are more stable over a five week interval while the remaining factors, as measured by the Cattell test may be expected to be less stable for the same period of time. Factors A (Cyclothymia), E (Dominance), M (Autia), H (Parmia)

Table II

Standardization Consistency Coefficients Compared with Test-Retest Stability Coefficients for the Sixteen Personality Questionnaire Factors.

| Factors | Standardization<br>Consistency<br>Coefficients <sup>a</sup> | Test-Retest<br>Stability<br>Coefficients <sup>b</sup> |
|---------|---|---|
| A       | .90   | .79   |
| B       | .86   | .52   |
| C       | .93   | .40   |
| E       | .91   | .68   |
| F       | .84   | .71   |
| G       | .85   | .41   |
| H       | .83   | .54   |
| I       | .76   | .48   |
| L       | .77   | .25   |
| M       | .88   | .64   |
| N       | .79   | .21   |
| O       | .85   | .73   |
| Q1      | .71   | .29   |
| Q2      | .79   | .55   |
| Q3      | .76   | .52   |
| Q4      | .88   | .72   |

<sup>a</sup> Based on 450 young adult males taking forms A and B together in one battery. Presented by R. B. Cattell, D. R. Saunders and G. Stice, Handbook for the Sixteen Factor Personality Questionnaire, Institute for Personality and Ability-Test, Champaign, Illinois, 1957, p. 4.

<sup>b</sup> Based on the 110 male college students taking forms A and B five weeks apart in this study.

and, of course, B (Intelligence) are pointed out by Cattell<sup>27</sup> as relatively heavily influenced by heredity. No strictly comparable stability figures to those reported here are available according to Cattell<sup>28</sup>, but what is available tends to lead one to expect a high stability for A (Cyclothymia) and a low stability for C (Ego Strength)<sup>29</sup>. The latter two expectations were borne out in the present study, but H (Parmia) and B (Intelligence), which Cattell regards as most influenced by hereditary factors were only very moderately stable for the subjects studied by this writer. However, recent clinical reports tend to indicate that H (Parmia) tends to rise during psychotherapy, that is, there is an increase in adventure-someness in successful psychotherapy.

Graphologically, the lesson to be learned is that one should address oneself first to the traits that tend to remain more stable - intelligence and the more heavily inherited traits or temperamental tendencies - and then to round out the picture with a consideration of the more contemporary condition of the subject. However, though the data presented here concerning the relative stability of the traits measured by the Cattell questionnaire is helpful, it should be pointed out that the stability coefficients, considered in themselves, are subject to attenuation

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27 Raymond B. Cattell, Personality and Motivation Structure and Measurement, N. Y., World Book, 1957, p. xiv-948.

28 Raymond B. Cattell, Private Communication, October 24, 1960.

29 Cattell, op. cit., p. 589-632.

due to the shortness of each of the forms. They must be interpreted, then, in a relative sense more than in an absolute sense.

iii. A Note on the Concept Validities of the Personality Variables. -

Cattell, Saunders and Stice<sup>30</sup> state, in the manual of the Sixteen Personality Factor Questionnaire, that "concept validities can be calculated in two ways: 1) from the known factor loadings of the items on the factors, and 2) from the split half reliability of the factor, assuming that the items have no 'specifics' in common but only the common factor, when validity is equal to the square root of reliability". This second approach to the calculation of validity for the factorially derived measure is also advocated by Cureton<sup>31</sup>. In Table III, the concept (or construct) validities estimated by the square roots of the respective split half reliability coefficients for the personality traits set down by Cattell, Saunders and Stice in their manual are compared with those which were found for the test as administered in this study.

The chief advantage of using a factorially derived instrument such as the Cattell test is that each trait measured is of relatively high factorial purity. It is evident, especially for factors L, N and Q1, that concept validity has been

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30 R. B. Cattell, D. R. Saunders and G. Stice, Handbook for the Sixteen Factor Personality Questionnaire, Institute for Personality and Ability Testing, Champaign, Illinois, 1957, p. 4.

31 E. E. Cureton, "Validity", in E. F. Lindquist (Ed.), Educational Measurement, Menasha, Wisconsin, Banta, 1955, p. 621-694.

Table III

Comparison of Experimental and Standardization Concept Validities of the Sixteen Personality Factors Estimated by the Square Roots of the Split Half Reliabilities<sup>a</sup>

|    | Experimental<br>Measurements <sup>b</sup> | Standardization<br>Measurements <sup>c</sup> |
|----|---|--|
| A  | .89                                       | .95  |
| B  | .72                                       | .93  |
| C  | .63                                       | .96  |
| E  | .82                                       | .95  |
| F  | .84                                       | .92  |
| G  | .64                                       | .92  |
| H  | .74                                       | .91  |
| I  | .69                                       | .87  |
| L  | .50                                       | .88  |
| M  | .80                                       | .94  |
| N  | .46                                       | .89  |
| O  | .86                                       | .92  |
| Q1 | .54                                       | .84  |
| Q2 | .74                                       | .89  |
| Q3 | .72                                       | .87  |
| Q4 | .85                                       | .84  |

a These validity estimates tend to run somewhat higher than those calculated from factor loadings.

b Based on the 110 male, right-handed college students serving as subjects in this study.

c Based on 450 young adult males. Presented by R. B. Cattell, D. R. Saunders and G. Stice, Handbook for the Sixteen Personality Factor Questionnaire, Institute for Personality and Ability Testing, Champaign, Illinois, 1957, p. 4.

reduced by the experimental conditions present in this study. But considerable concept validity remains for most of the variables. Contemporary psychometric thinkers are beginning to place greater emphasis upon factorial purity or concept validity. The patterns of correlations between the personality and handwriting variables are functions of both the reliability and validity of the personality variables. Since the experimental concept validities are higher than the experimental reliabilities of the personality variables, the correlational patterns between the handwriting and personality variables are effected less by the drop in validity than in the drop in reliability. Much of the value of factorial purity or concept validity sought in using the Cattell test still remained despite experimental conditions.

In this section the experimental reliabilities and validities of the personality criteria have been presented and commented upon. In the final chapter, Discussion, these data were used as one of the criteria for assessing the relative strength of the sixteen graphological hypotheses stated there. If both reliability and validity were relatively high for a given personality trait, the hypothesis about the prediction of that trait was regarded as more firmly based thereby.

## 2. The Handwriting Personality Correlations.

### A. Some General Remarks.

The experimental reliabilities of the personality criteria variables vary with the manner in which the personality tests are administered, as has just been shown. The handwriting-personality correlations to be presented in Table IV were reduced by lower reliabilities as in this case, as a consequence. In spite of this, however, three correlations were found to be significant at the one percent level and twenty-one significant at the five percent level. The correlations were calculated by the cosine-pi tetrachoric formula, which, having higher standard errors than product moment correlations, demand higher correlations for statistical significance, of course. This, in a sense, means that by using the less sensitive statistical procedure, the data may lose some of its significance. This risk has been taken to gain time in the handling of a large number of correlations. Once it became clear that the lower of the two sets of criteria reliability estimates (the stability coefficients) was probably more accurate, the writer then became interested in the pattern of the handwriting personality correlations, more than in their sizes. At the same time, it was clear that the study would have primarily exploratory value, for the same reason. It seems extremely unlikely that the pattern of correlations (or of multiple correlations presented in Chapter IV) is dismissable as a chance phenomenon. However, nothing more is asserted than that there now exists a clearer hypothetical framework for further research

## BASIC STATISTICAL RESULTS

Table IV

Tetrachoric Correlations Between All Pairs of Handwriting and Personality Variables Studied<sup>a</sup>

| Handwriting Variables                              | Personality Variables |       |       |       |       |      |     |      |     |      |       |     |      |     |       |     |
|--|-----------------------|-------|-------|-------|-------|------|-----|------|-----|------|-------|-----|------|-----|-------|-----|
|  | A                     | B     | C     | E     | F     | G    | H   | I    | L   | M    | N     | O   | Q1   | Q2  | Q3    | Q4  |
| 1. Writing Speed                                   | -14                   | -20   | 08    | -03   | 20    | -08  | -08 | -08  | 08  | -14  | 14    | 03  | 14   | -03 | 08    | -14 |
| 2. Disconnectedness                                | 14                    | 03    | (-41) | /-31/ | -03   | -25  | -20 | 03   | -08 | 20   | -20   | 03  | -03  | 31  | /-31/ | 08  |
| 3. Top Border W.                                   | 03                    | 14    | -03   | 03    | -03   | 20   | -14 | -08  | 03  | -08  | -08   | -08 | 08   | -03 | 20    | 03  |
| 4. Paragr. Indent. D.                              | 03                    | 25    | 14    | 03    | 20    | 08   | 03  | -03  | -03 | -08  | 20    | 08  | -03  | 08  | -20   | 20  |
| 5. Left Border W.                                  | /31/                  | 08    | -20   | -14   | -03   | 14   | -14 | -08  | -03 | -08  | -03   | 25  | -20  | -08 | -08   | 08  |
| 6. Right Border W.                                 | 08                    | (41)  | -03   | 08    | 20    | 08   | -14 | 03   | 03  | 14   | -14   | 14  | /31/ | 25  | -03   | 08  |
| 7. Dist. between Lines                             | 20                    | 25    | 14    | -08   | -14   | 14   | -03 | -03  | -20 | /31/ | -03   | -08 | 20   | 08  | -08   | 20  |
| 8. Dist. between Words                             | -03                   | 20    | 03    | -20   | -20   | -14  | -08 | 20   | 03  | 03   | /-31/ | 14  | /31/ | 03  | -14   | -03 |
| 9. Word Dist. Span                                 | 08                    | 25    | -08   | -25   | /-31/ | 14   | -14 | 25   | 03  | 14   | -08   | 14  | 08   | -03 | -25   | 14  |
| 10. Dist. between Letters                          | /36/                  | 14    | -03   | 08    | 03    | 14   | 08  | 20   | -14 | -08  | 03    | 14  | 08   | -14 | 08    | 03  |
| 11. Letter Width                                   | 20                    | -08   | 25    | -03   | 08    | -03  | 03  | 14   | -08 | -03  | 14    | 03  | -08  | -14 | -25   | -08 |
| 12. Capital Letter Ht.                             | /31/                  | -03   | 14    | 08    | 08    | 14   | -03 | 14   | -14 | -03  | 20    | -08 | 03   | -08 | 03    | 08  |
| 13. Lower Zone Ht.                                 | 20                    | -03   | 20    | -03   | 20    | -08  | -03 | 08   | -03 | 08   | 14    | -08 | 03   | 03  | -25   | -20 |
| 14. Slant (Backh.-Foreh.)                          | /31/                  | -25   | 03    | 08    | 14    | -14  | -08 | 08   | -03 | -03  | -03   | 08  | 03   | -14 | 14    | 14  |
| 15. U.Z. Letter Ht.                                | /31/                  | -08   | -03   | -08   | -03   | 14   | 03  | /31/ | 08  | -08  | 25    | -08 | -03  | -08 | -14   | -08 |
| 16. Middle Zone Ht.                                | 08                    | -14   | 14    | -08   | -03   | 03   | 03  | /31/ | -25 | 14   | /31/  | -20 | -08  | -03 | -08   | -14 |
| 17. Inclination (Desc.-Asc.)                       | 25                    | 14    | -03   | 08    | 03    | -03  | 25  | 03   | -03 | 03   | -14   | -03 | 08   | -03 | 20    | 08  |
| 18. Span of Inclination                            | -14                   | -03   | -08   | 14    | 03    | 08   | -03 | /31/ | 20  | 14   | -08   | 25  | -20  | -20 | -03   | 14  |
| 19. Total Loopiness                                | -20                   | -03   | 08    | /-31/ | -20   | /31/ | -20 | 08   | 14  | 08   | 03    | -14 | 03   | -03 | 03    | -03 |
| 20. U.Z. Loopiness                                 | 08                    | 08    | 03    | -20   | -08   | -03  | -08 | -03  | 14  | 08   | -08   | -14 | 25   | 08  | -08   | -14 |
| 21. L.Z. Loopiness                                 | 08                    | -03   | 20    | 03    | 03    | 25   | 14  | -08  | -03 | -25  | 03    | -20 | 08   | -03 | 03    | -20 |
| 22. M.Z. Loopiness                                 | -14                   | -03   | -03   | -03   | -03   | 20   | 03  | 08   | 08  | 08   | 14    | -03 | 03   | -14 | 03    | 03  |
| 23. Capital Letter Ht.<br>U.Z. Letter Ht.          | 20                    | /-31/ | -20   | 20    | -03   | -03  | 14  | -14  | -20 | -03  | 03    | 20  | -08  | -14 | -03   | 08  |
| 24. L.Z. Ht. + U.Z.L. Ht. <sup>b</sup>             | 25                    | -03   | 09    | -03   | -03   | 09   | 09  | (41) | -03 | 14   | 20    | -03 | -08  | -14 | -25   | -03 |
| 25. L.Z. Ht. + U.Z.L. Ht. <sup>c</sup><br>M.Z. Ht. | -03                   | -03   | 20    | 03    | 03    | 25   | -03 | -25  | -20 | /31/ | -25   | -14 | 14   | 08  | 08    | -08 |

a. N = 110 male, right-handed college students. Decimals have been omitted. Correlations designated ( ) were significant at the one percent level. Correlations designated / / were significant at the five percent level.

b. Also referred to as "total height".

c. Also referred to as "the ratio of the total height to the middle zone height".

than previously was available.

B. Detailed Statistical Remarks.

Both the handwriting and the personality variables were dichotomized at their medians, as recommended by Guilford<sup>32</sup>, especially since his usage was followed for calculating the tetrachoric correlations by the cosine-pi method. An assumption of rectilinearity of regression is also required for the use of tetrachorics, and this was made since no curvilinearity was observed. No statistical tests were made, however.

Calculating by the formula provided by Guilford<sup>33</sup>,

$$r_{T+} = \frac{\sqrt{pp'qq'}}{yy' \sqrt{N}}$$

a tetrachoric correlation of .38 would be required to refute the null hypothesis at the one percent level of significance and of .29 at the five percent level. The three correlations significant at the one percent level and the twenty-one correlations which were significant at the five percent level are pointed out in Table IV. It will be recalled from Chapter I that Birge found only a few significant differences between means out of a very large number calculated and determined to accept

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<sup>32</sup> J. P. Guilford, Fundamental Statistics in Psychology and Education (3rd Ed.), N. Y., McGraw-Hill, 1956, p. 307.

<sup>33</sup> Ibid., p. 309.

the null hypothesis. The present writer, however, has elected to publish all the correlations found, because of the indications that the majority of these have been reduced by criteria attenuation. That there exists a possibility of the correlations presented in Table IV being due to chance cannot be denied. But as has been seen earlier in the present chapter, the handwriting measurements entering the calculations of these correlations have very satisfactory measurement reliabilities, and, consequently can be thought of as exerting a strong influence on the pattern of the correlations of Table IV. Furthermore, and in spite of, the attenuation in the criteria, there should still exist a measure of reliability and validity in their measurement of the personality variables in question. But conservatively, the writer has interpreted the correlations as having only exploratory and hypothetical value, as has already been pointed out in the prior section of the present chapter, General Remarks.

Some consideration was given to the possibility that the higher correlations of Table IV be corrected for attenuation, but the writer decided that it would be more satisfactory to work directly with the experimental figures in an area of research as little explored as the present one, particularly since five weeks passed between test and retest of the personality variables in this study.

Theoretically, however, if the handwriting and the personality variables were measured, all in one sitting<sup>34</sup>, say in a single afternoon, the pattern of

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34 Ideally all three forms of the Cattell test in one continuous battery

correlations should emerge much more clearly, and a greater number of them be found statistically significant. If such a design could be executed, many sources of error would be removed.

In general, Table IV tends to support the assertion of the Klages school of graphology that no single handwriting trait can be taken by itself out of its context to predict a personality trait, and, conversely, no personality trait manifests itself in but a single handwriting trait. Further exploration of the interpretative significance of the data of the present chapter is reserved to the final chapter, Discussion. In that chapter all the data gathered in the study are evaluated in an overall fashion.

### 3. The Handwriting Variable Intercorrelations.

In order that all data required for a thorough multiple correlation analysis might be at hand, a complete table of intercorrelations of all pairs of handwriting variables was computed. This is Table V. The correlations of Table V are again tetrachorics. A tetrachoric correlation of .38 is required for significance at the one percent level, as noted on page forty-four above, for 110 cases. On this basis, and in view of the high experimental reliabilities of the handwriting variables, it is readily asserted that there exist a number of significant

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should be administered, an undertaking surely no more painful than the taking of the MMPI, since the total number of questions would be roughly the same.

BASIC STATISTICAL RESULTS

Table V

Intercorrelation Matrix of All Handwriting Variables <sup>a</sup>

|                                   | 1 | 2   | 3   | 4     | 5   | 6   | 7   | 8   | 9   | 10  | 11  | 12  | 13  | 14  | 15  | 16  | 17  | 18  | 19  | 20  | 21  | 22  | 23  | 24  | 25  |  |
|-----------------------------------|---|-----|-----|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|
| Writing Speed                     |   |     |     |       |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| Disconnectedness                  |   |     |     |       |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| Top Border W.                     |   |     |     |       |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| Paragr. Indent. D.                |   |     |     |       |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| Left Border W.                    |   |     |     |       |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| Right Border W.                   |   |     |     |       |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| Dist. between Lines               |   |     |     |       |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| Dist. between Words               |   |     |     |       |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| Word Dist. Span                   |   |     |     |       |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| Dist. between Letters             |   |     |     |       |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| Letter Width                      |   |     |     |       |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| Capital Letter Ht.                |   |     |     |       |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| Lower Zone Ht.                    |   |     |     |       |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| Slant (Backh. - Foreh.)           |   |     |     |       |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| U.Z. Letter Ht.                   |   |     |     |       |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| Middle Zone Ht.                   |   |     |     |       |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| Inclination (Desc. - Asc.)        |   |     |     |       |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| Span of Inclination               |   |     |     |       |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| Total Loopiness                   |   |     |     |       |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| U.Z. Loopiness                    |   |     |     |       |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| L.Z. Loopiness                    |   |     |     |       |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| M.Z. Loopiness                    |   |     |     |       |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| Capital Letter Ht.                |   |     |     |       |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| U.Z. Letter Ht.                   |   |     |     |       |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| L.Z. Ht. + U.Z.L. Ht.             |   |     |     |       |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| L.Z. Ht. + U.Z.L. Ht.<br>M.Z. Ht. |   |     |     |       |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| 1                                 |   | -20 | 08  | 08-08 | -08 | -36 | -14 | -25 | 14  | 20  | 25  | 25  | 31  | 25  | 31  | 08  | -31 | 31  | 14  | 08  | 31  | -03 | 03  | -25 |     |  |
| 2                                 |   |     | -20 | 20    | 14  | 08  | 08  | 14  | 03  | -14 | -08 | 03  | -03 | -14 | 03  | 03  | 20  | 03  | -08 | 20  | -08 | 20  | 14  | 08  | -20 |  |
| 3                                 |   |     |     | 14    | 52  | 31  | 20  | -36 | -36 | -20 | -08 | 03  | -03 | 08  | -03 | -14 | 03  | -20 | -25 | -03 | -20 | -20 | -03 | -08 | 08  |  |
| 4                                 |   |     |     |       | -03 | 08  | 08  | -14 | -08 | -03 | 03  | 14  | -08 | -03 | 14  | -03 | 14  | -14 | 14  | -08 | -03 | 08  | -25 | 08  | 14  |  |
| 5                                 |   |     |     |       |     | 41  | 14  | -03 | -08 | -31 | -03 | 03  | 08  | -08 | 08  | -03 | 08  | -03 | -08 | 20  | -03 | -14 | -03 | 08  | -14 |  |
| 6                                 |   |     |     |       |     |     | 08  | -03 | 03  | -20 | -20 | 14  | 03  | -03 | 03  | -14 | 03  | 08  | -03 | -03 | 03  | -14 | 03  | 03  | 14  |  |
| 7                                 |   |     |     |       |     |     |     | 08  | 03  | 20  | 20  | 41  | 41  | 08  | 31  | 20  | -20 | 25  | 08  | 03  | -08 | -08 | -03 | 52  | 14  |  |
| 8                                 |   |     |     |       |     |     |     |     | 61  | 31  | 08  | -14 | 20  | -03 | 14  | -14 | 14  | -08 | -08 | 14  | -03 | 08  | -14 | 20  | 03  |  |
| 9                                 |   |     |     |       |     |     |     |     |     | 36  | 14  | 14  | 08  | -20 | 08  | 03  | 25  | 20  | -08 | 08  | 03  | -14 | 08  | 14  | 03  |  |
| 10                                |   |     |     |       |     |     |     |     |     |     | 52  | 36  | 14  | 20  | 31  | 31  | 14  | 08  | 03  | 36  | -20 | 03  | 14  | 20  | -03 |  |
| 11                                |   |     |     |       |     |     |     |     |     |     |     | 46  | 31  | 20  | 41  | 52  | -20 | 03  | 14  | 20  | 08  | 20  | 03  | 41  | -03 |  |
| 12                                |   |     |     |       |     |     |     |     |     |     |     |     | 52  | 46  | 84  | 61  | 20  | 31  | 25  | 36  | 08  | 08  | 36  | 73  | 08  |  |
| 13                                |   |     |     |       |     |     |     |     |     |     |     |     |     | 36  | 81  | 46  | -03 | 36  | 41  | 41  | 08  | 25  | -31 | 84  | 31  |  |
| 14                                |   |     |     |       |     |     |     |     |     |     |     |     |     |     | 41  | 14  | -08 | 14  | -14 | -20 | -08 | -31 | 25  | 36  | 25  |  |
| 15                                |   |     |     |       |     |     |     |     |     |     |     |     |     |     |     | 69  | 14  | 20  | 41  | 46  | 08  | 20  | -20 | 96  | 03  |  |
| 16                                |   |     |     |       |     |     |     |     |     |     |     |     |     |     |     |     | -25 | 08  | 46  | 41  | 08  | 46  | -20 | 69  | -56 |  |
| 17                                |   |     |     |       |     |     |     |     |     |     |     |     |     |     |     |     |     | -31 | 03  | 25  | 41  | -08 | 20  | -03 | 31  |  |
| 18                                |   |     |     |       |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 08  | -03 | 08  | 03  | 03  | 31  | 14  |  |
| 19                                |   |     |     |       |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 73  | 41  | 90  | -31 | 46  | -14 |  |
| 20                                |   |     |     |       |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 08  | 52  | -14 | 52  | -03 |  |
| 21                                |   |     |     |       |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 25  | 14  | 46  | 14  |  |
| 22                                |   |     |     |       |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| 23                                |   |     |     |       |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| 24                                |   |     |     |       |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| 25                                |   |     |     |       |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |

<sup>a</sup> N=110. Decimals omitted. Tetrachoric correlations. For the statistical significance of variables, see the text.

intercorrelations among the handwriting variables studied. Some caution must be exercised, however, in interpreting some of the correlations. Some overlap of measurement appears to have taken place. Total loopiness overlaps the other loopiness measures to some degree. Variables 23, 24, and 25 are arithmetic combinations of other variables; these and other combinations have been regarded as important in graphological studies. Of particular interest has been the ratio of several variables individually and in combination to the height of the middle zone. The reliability of measurement of the height of the middle zone was the lowest for any of the handwriting measurements, and hence only the ratio, the sum of the lower zone height and the height of the upper zone letters to the middle zone height, has been studied. It appears to the writer that the use of arithmetic combinations of variables may introduce spurious correlation in some cases, because of the tendency of such measures to overlap in measurement. Consequently the reader is counselled to regard them with suspicion as the writer has done.

In a prior, unpublished, master's thesis<sup>35</sup> the writer studied the factorial structure of twelve rated handwriting variables. No factorial study was made of the variables measured in this study because, though they are, of course of some interest in themselves, the meaning of the factors which would emerge

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<sup>35</sup> Wilburn R. Mann, A Factor Analytic Study of Psychographology, Unpublished M. A. Thesis, Catholic University of America, Washington, D. C., 1953, p. iii-45.

as personality predictors would be obscured by the reduced criterion reliability in this study about which the writer has already spoken. A more logical strategy for the present study seemed to be to explore the data of this chapter by multiple correlation analysis. This approach was chosen because it would further clarify which of the several correlations in combination with the handwriting variable intercorrelations would tend to increase the accuracy of prediction of the experimental personality criteria of the present study. Further, since several rather large correlations between the handwriting variables themselves were found in the construction of Table V, it seemed possible that some of these might be found to function as suppressor variables. With these objects in mind the multiple correlation analysis which is the subject of the following chapter was undertaken.

## CHAPTER IV

### EXPLORATION OF THE DATA OF CHAPTER III BY MULTIPLE CORRELATIONS

#### 1. The Multiple Correlations in General.

Before undertaking a discussion of the multiple correlations found, the conditions for their proper interpretation must be set down.

a) It will be recalled that the criteria with which they correlate are the sums of the raw scores of Forms A and B of the Sixteen Personality Factor Questionnaire. These two forms were regarded as equivalent and administered at an interval of five weeks. The criteria, then, represent the statistical average of the subjects for the personality traits measured for the five week period.

b) It will also be recalled that two estimates of the experimental reliabilities of the criteria variables were made. The high estimates were the consistency coefficients by Cattell in his manual for the test. These were based on Forms A and B administered as one battery. The low estimates were made by calculating the split-half reliability coefficients for Forms A and B with a period of five weeks intervening (or the stability coefficients for the variables). The second, lower estimates, of criteria reliabilities were regarded as the more probably accurate estimates of the experimental reliabilities for the conditions of this study.

c) The handwriting personality correlations would theoretically rise if the two forms of the Cattell Test were administered as one battery.

The multiple correlation analysis was made, then, primarily as an exploratory step to see which of the several handwriting variables correlating  $\pm .20$  or higher with the personality criteria might best combine to improve prediction. They are set forth tentatively and are subject to confirmation. They are primarily of exploratory value and aided in the development of the objective hypotheses stated and evaluated in Chapter V. The multiple correlations found are listed in Table VI.

The particular variables used to obtain the above multiple correlations were selected in the following way: All predictor-criterion correlations which were  $.20$  or higher either positive or negative were listed for each personality criterion in turn. Then the table of handwriting correlations was examined systematically for all possible suppressor variables (variables correlating  $-.14$  to  $+.14$  with each criterion variable involved and at the same time  $\pm .41$  or higher with another predictor of the same criterion variable). The average correlation of suppressors with criterion variables was  $+.017$  and the average inter-correlation of the suppressors with other predictor variables was  $+.62$ . In the next step a table of correlations including all variables located in the prior two steps was set down. This table was examined and variables which correlated with other predictors except suppressors as high or higher than they did with the

Table VI  
Multiple Correlations of Handwriting Traits with  
Personality Traits

| Factors | Multiple<br>Correlations |
|---------|--------------------------|
| A       | .626                     |
| B       | .618                     |
| C       | .520                     |
| E       | .475                     |
| F       | .534                     |
| G       | .460                     |
| H       | .425                     |
| I       | .547                     |
| L       | .467                     |
| M       | .453                     |
| N       | .432                     |
| O       | .408                     |
| Q1      | .495                     |
| Q2      | .450                     |
| Q3      | .538                     |
| Q4      | .305                     |

criterion being studied were dropped. A few combinations of variables emerged which maximized suppressive influence and predictive influence as far as could be determined by inspection in the light of the discussion on multiple correlation and the action of suppressor variables by Guilford<sup>36</sup>. Finally these several combinations of variables were each solved by the Doolittle<sup>37</sup> method and the one producing the highest multiple correlation, using no more than one suppressor variable, was the one reported here.

Unfortunately, to the knowledge of the writer, no formula exists for calculating the standard error of a multiple correlation calculated from tetrachoric correlations. The formula

$$\sigma_R = \frac{(1-R^2)}{\sqrt{N-m}}$$

applies only to multiple correlations derived from product-moment correlations. If the tetrachoric correlations used were perfect approximations of product-moment correlations, this formula could be used. But as Guilford<sup>38</sup> points out tetrachoric correlations are subject to standard errors at least half again the size of the standard errors of the corresponding product-moment correlations. Conservatively, then, no specific assertion is made as to the statistical

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<sup>36</sup> J. P. Guilford, Fundamental Statistics in Psychology and Education (3rd Ed.), New York, McGraw-Hill, 1956, p. 401-415.

<sup>37</sup> The Wherry-Doolittle method may have been more satisfactory here.

<sup>38</sup> Guilford, op. cit., p. 308.

significance of the multiple correlations.

In the ensuing outline of the multiple correlations individually only statistical details will be set forth, for ready statistical reference. A more psychological and graphological interpretative discussion of the prediction of the personality traits from the handwriting traits will be found in Chapter V. Here too, primary attention will be given to the handwriting variable correlations with the various personality criteria. Should the reader wish to obtain the correlations between the handwriting variables themselves these are all readily available in Table V from which, of course, they were taken. The handwriting variable intercorrelations will receive no discussion except where there has been a specifically suppressive influence. As has been pointed out, a major objective in the multiple correlation analysis has been to discover the suppressive variables, since they are of considerable interest in themselves.

The attention of the reader for the present, then, will be focused upon the handwriting variables which actually entered the multiple correlations. These may well be confirmed as the best predictors, taken in combination, of the criteria studied by subsequent research. Other handwriting variables correlating  $\pm 20$  or more with various personality criteria (see Table IV) should not be completely dismissed from mind. The writer will return to them again in the final interpretative summing up in Chapter V.

2. The Multiple Correlations Considered Specifically, In Turn,  
In Purely Statistical Fashion.

Factor A - Cyclothymia

Cyclothymia was best predicted by a combination of the left border width ( $r = .31$  with A), distance between the letters ( $r = .36$  with A) and the capital letter height ( $r = .31$  with A). The resulting multiple correlation was .626.

Factor B - General Intelligence

General intelligence was predicted best by the width of the right border ( $r = .41$  with B), the distance between the lines ( $r = .25$  with B), word distance span ( $r = .25$  with B), the ratio of the capital letter height to the height of the upper zone letters ( $r = -.31$  with B), with intercorrelations between these variables generally low. The multiple correlation was .618.

Factor C - Ego Strength

Ego strength was best predicted by disconnectedness ( $r = .741$  with C) and letter width ( $r = .25$  with C) with distance between the letters used as a suppressor. The correlation between letter width and the distance between the letters was .52. The resulting multiple correlation was also .52.

Factor E - Dominance

Dominance was best predicted by disconnectedness ( $r = -.31$  with E), word distance span ( $r = -.25$  with E) and total loopiness ( $r = -.31$  with E). The multiple correlation was .475.

Factor F - Surgency

Surgency was best predicted by the width of the right border ( $r = .20$  with F), word distance span ( $r = .31$  with F) and the height of the lower zone ( $r = .20$  with F). The height of the upper zone letters acted as a suppressor and correlated .81 with the height of the lower zone. The multiple correlation reached .534.

Factor G - Super Ego

Super Ego was best predicted by disconnectedness ( $r = -.25$  with G), total loopiness ( $r = .31$  with G) and the ratio of the total height to the middle zone height ( $r = .25$  with G). The multiple correlation found was .460.

Factor H - Parmia

Parmia or inherited boldness was best predicted by disconnectedness ( $r = -.20$  with H), inclination ( $r = .25$  with H) and total loopiness ( $r = -.20$  with H). The multiple correlation was .425.

Factor I - Premsia

Premsia was best predicted by the middle zone height ( $r = .31$  with I), span of inclination ( $r = .31$  with I) and lower zone height plus

the upper zone letter height (or total height) ( $r = .41$  with I). Distance between the lines acted as a suppressor; it correlated  $-.03$  with I and  $.52$  with total height. The multiple correlation was  $.547$ .

#### Factor L - Protension

Protension was best predicted by the middle zone height ( $r = -.25$  with L), the span of inclination ( $r = .20$  with L); while the upper zone letter height acted as a suppressor. The upper zone letter height correlated  $.08$  with L and  $.69$  with the middle zone height. The resulting multiple correlation was  $.467$ .

#### Factor M - Autia

Autia was best predicted by a combination of the distance between the lines ( $r = .31$  with M), the lower zone loopiness ( $r = -.25$  with M) and variable 25, the total height divided by the middle zone height ( $r = .31$  with M). Inclination acted as a suppressor and correlated  $.03$  with M,  $.41$  with lower zone loopiness and  $.31$  with variable 25. The resulting multiple correlation was  $.453$ .

#### Factor N - Shrewdness

Shrewdness was best predicted by the distance between the words ( $r = -.31$  with N), and the upper zone letter height ( $r = .25$  with N) with the lower zone height acting as a suppressor. The lower zone height correlated  $.14$  with N and  $.81$  with the upper zone letter height. The resulting multiple correlation was  $.432$ .

Factor O - Guilt Proneness or Timidity

Guilt proneness was predicted by a combination of the width of the left border ( $r = .25$  with O) and the span of inclination ( $r = .25$  with O). The width of the top border acted as a suppressor and correlated  $.52$  with the width of the left border. The multiple correlation was  $.408$ . It was also found that the width of the right border could serve a more limited suppressant function. It correlates  $.41$  with the width of the left border.

Factor Q<sub>1</sub> - Radicalism

Radicalism was best predicted by the width of the right border ( $r = .31$  with Q<sub>1</sub>), the distance between the words ( $r = .31$  with Q<sub>1</sub>) and the upper zone loopiness ( $r = .25$  with Q<sub>1</sub>). The multiple correlation was  $.495$ .

Factor Q<sub>2</sub> - Self Sufficiency

Self sufficiency was best predicted by a combination of disconnectedness ( $r = .31$  with Q<sub>2</sub>) and the width of the right border ( $r = .25$  with Q<sub>2</sub>), with the width of the left border acting as a suppressor and correlating  $.41$  with the width of the right border. The multiple correlation was  $.450$ .

Factor Q<sub>3</sub> - High Self-Sentiment Formation

High self-sentiment was best predicted by a combination of disconnectedness ( $r = -.31$  with Q<sub>3</sub>) word distance span ( $r = -.25$  with Q<sub>3</sub>) the sum of the lower zone and the upper zone letters ( $r = -.25$  with Q<sub>3</sub>) the height of the capital letters acted as a suppressor correlated  $.73$  with the sum of the lower zone and the upper zone letters. The resultant multiple correlation was  $.538$ .

Factor Q<sub>4</sub> - Ergic Tension

Ergic tension was best predicted by the lower zone height ( $r = -.20$  with Q<sub>4</sub>) and lower zone loopiness ( $r = -.20$  with Q<sub>4</sub>) while the upper zone letter height acted as a suppressor. The upper zone letter height correlated  $-.08$  with Q<sub>4</sub> and  $.81$  with the lower zone height. The multiple correlation was  $.305$ .

Such discussion and generalization of the above presented multiple correlation analysis <sup>is</sup> and is appropriate and the general implications of the data presented in this paper will be found in Chapter V, Discussion. The reader may be interested in the relationship of the handwriting variables studied here to the higher order factors of extroversion-introversion, anxiety, sensitivity, unbroken success - vs - maturity by frustration, constitutional adaptivity and catatonic disposition. The natures of these higher order factors are still being studied. No effort was made to derive the scores for the higher order factors in the present study because Forms A and B were not administered as one battery and if these factor scores were calculated they would not have the same meaning as if the two forms of the test had been administered as a single battery. Then, too, application of the multiple regression equations derived by Cattell would not apply to the present data and specific calculation of regression equations for this data would not be widely enough generalized in meaning to be of particular value.

## CHAPTER V

### DISCUSSION

#### 1. Necessary Preliminary General Remarks and the Organization of the Chapter

As pointed out in Chapter IV the multiple correlation analysis was exploratory. It was a step in the direction of delineating objectively groups of handwriting traits or handwriting syndromes symptomatic of the sixteen personality variables studied from among the twenty-five handwriting traits measured. The twenty-five handwriting traits do not exhaust the handwriting domain. As pointed out in Chapter II handwriting variables have been classified into signs, ratable characteristics of the handwriting as a whole and measurable characteristics of the handwriting as a whole. The twenty-five variables chosen for study were all in the latter category. The general strategy of this research effort has been to explore these variables in relation to the sixteen personality traits in the hope that a firmer statistical basis could be developed in experimental graphology. Not all the measurable characteristics of handwriting were included. No attempt was made to include the very important pressure variables, for example. The major results of this paper are the sixteen graphological hypotheses to be set down shortly. These need further study in themselves. They should not be thought of as standing by themselves, for they represent only

beginning steps in an ideal complete system of experimental graphology which would include all variables, quantitative and qualitative which are susceptible to objective measurement or classification.

The sixteen graphological hypotheses are set down in the same order in which they were stated statistically in Chapter IV and in the manual for the Sixteen Personality Factor Questionnaire.

There were handwriting measurements, other than those entering the multiple correlations, correlating with most of the personality factors. These will be considered in the ancillary discussion following the main hypothesis for the prediction of each personality factor. Limited graphological comments are made from the writer's background and experience. These are not systematic nor representative of any particular school of graphological rationale. They are set down by way of commentary only. They only indicate something of the prior expectations and surprises of this writer as the data unfolded.

One school of graphology, the Klages school, has aroused the greatest interest among members of the American Psychological Association as was noted in the introduction. But even here interpretation of many specific traits of handwriting is left to intuition.

Two major organized groups of active graphological practitioners in North America are the American Graphological Association with headquarters in New York City and the International Society for Grapho-Analysis, with offices in St. Louis, Missouri and London, England. Each pretty much repudiates the other. The Grapho-Analysis group, however, is very restrictive of its membership, and has a much more extensive training program for its membership than the American Graphological Society.

Though both are attempting to predict personality and character traits, neither has published any validation data which would be acceptable by ordinary scientific standards. The writer has not associated himself by membership or otherwise with either of these organizations.

The only organization in North America pursuing, as a matter of regular policy, scientific study of graphological problems is the Handwriting Institute of New York. The criticism of this group is particularly invited.

This writer is not a practising graphologist, but rather a student of experimental graphology. In this study it appears that some data new to experimental graphology have evolved. Like the study of McNeill and Blum it shows that trait studies are valuable, though they are not the only possible route to a complete experimental graphology.

Werner Wolff<sup>39</sup> has made the closest approach among serious students of graphology to the personality research of Cattell. In an appendix to his Diagrams of the Unconscious, Wolff set down the list of major surface traits defined by Cattell in a stage of research of twenty-five years ago. Along side of each surface trait he set down what he recognized as its chief handwriting symptoms qualitative and quantitative. The student who wishes to work toward a complete integration of the rationale of graphology with psychology will not overlook the works of Wolff. But the objective of total integration of serious graphological rationale with psychology cannot be undertaken here.

The chief reason for setting forth all the data, both stronger and weaker hypotheses, found in the course of this investigation is the hope that through further research the hypotheses will be tested and elaborated. Theoretically, as has been noted in the statistical chapters, the first order correlations have been lowered by the limited experimental criteria reliabilities of the personality variables studied.

In the opinion of the writer all too little attention, generally speaking, has been paid to the experimental reliabilities of criteria. For example Lorr, Lepine and Golder<sup>40</sup>, reported the factorial structure of a large number of

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39 Werner Wolff, Diagrams of the Unconscious, N. Y.; Grune and Stratton, 1948, p. 423.

40 M.Lorr, L. T. Lepine, and J.V. Golder, "A Factor Analysis of Some Handwriting Characteristics", in the Journal of Personality, Vol. 22, 1954, p. 348-353.

handwriting traits. Also they reported that they correlated their handwriting traits with personality traits derived through factor analyses of questionnaire material. They reported only that correlations were uniformly low, but stated nothing about the experimental reliabilities of the personality factor questions they used. They also did not present any of the actual correlations. McNeil and Blum, on the other hand, used the Blacky Test in their study as was pointed out in the survey of prior research in this study. Their criterion reliability was higher and they reported a number of significant relationships between handwriting traits and psycho-sexual dimensions of personality. That far better experimental reliabilities are possible for the Cattell personality variables studied in this paper is indicated by the reliabilities reported for the variables in Cattell's manual and to be found in Table 2 of this paper. But that higher experimental reliability would actually raise the first order handwriting personality correlations reported in this study must be established experimentally. Later in this Chapter this point will be taken up again in the section on suggestions for further research.

On completion of the statement of the sixteen hypotheses and the ancillary discussion the writer will point out some findings which were unexpected from the standpoint of graphological theory. This will be followed by suggestions for more nearly critical experimentation and some promising alternative approaches to graphological research. The chapter will conclude with a summary and general conclusions.

The generalizations expressed in this Chapter refer to the population of young college males sampled. They may be even quite misleading for samples of other populations.

2. Sixteen Graphological Hypotheses and Relevant Ancillary Discussion.

These hypotheses are essentially restatements of the multiple correlations of Chapter IV, but in this restatement the effort is made to express them in less statistical style. In this restatement all the negative correlations will be expressed by their opposites for stylistic clarity. For example instead of using only the term disconnectedness as in Chapter IV, the writer will use connectedness to indicate that a given personality trait tends to be associated with increasingly joined together letters instead of speaking of a negative correlation of a variable with disconnectedness. This manner of proceeding will permit all the relationships in the hypotheses and the ancillary discussion to be cast in positive terms. The specific signs of correlations and directions of variables as used experimentally have already been stated in the prior chapters, for ready reference. The hypotheses can now be stated.

The hypotheses are:

1) Factor A (Cyclothymia) is especially characterized by the combination of a wider left border, greater distance between letters and larger capital letters. The intercorrelations between these variables were smaller than for any other combination of handwriting variables studied which correlated with cyclothymia. However, several other combinations were tried and resulted in multiple correlations of .5 or better. These other handwriting traits also tend to characterize cyclothymia: righthand slant, higher upper zone letters and an ascending writing line. Cyclothymia is a major component of the higher order extroversion factor. Graphologists have tended to be concerned with the more general trait of extroversion. Some variables correlating with cyclothymia have been used in the prediction of extroversion, especially right hand slant, larger capital letters and wider left border.

2) Factor B (Power Measure of the G-Factor in Mental Ability) is especially characterized by a wider right border, a wider distance between the lines, a greater word distance span and a smaller ratio of capital letter height to upper zone letter height. Other associations with B are a slower writing speed, a deeper paragraph indenture depth, greater distance between words and a more backhand slant. Graphologists have long associated ample and generally regular or balanced spacing with intelligence. The spacing element is very much in evidence in this study, to be sure. The strongest relationship to this measure of general mental ability is the width of the right border.

3) Factor C (Ego Strength) is especially characterized by connectedness and wide letters and prediction is enhanced by the suppressive action of the distance between letters. The person of stronger ego tends also to have a narrower left border, a higher middle zone, a greater number of lower zone loops, a smaller ratio of capital letters height to upper zone letter height and a larger ratio of total letter height to middle zone letter height. Graphologists have previously recognized connectedness and greater letter width as indicative of ego strength.

4) Factor E (Dominance) is especially characterized by a combination of small word distance span, connectedness and fewer total loops. The writing of the dominant individual tends to be highly connected, to be even and regularly spaced between words and to have fewer loops than that of the submissive person. The writing might be described as very regular and somewhat angular in quality. Other variables tending to be associated with dominance to a lesser degree were small distance between words and a large ratio of capital letter height to upper zone letter height. From graphological rationale the writer expected to find this relative angularity. The lack of loopiness probably expresses it. The connectedness and small regular spacing between words also found suggest a steadiness - or lack of hesitancy - which are consistent with dominance. At the same time this regularity may indicate an unreflectiveness as well as a steadiness of effort - a stubbornness - in short, which is also consistent with the notion of "choleric temperament" and dominance. Dominance

is reported by Cattell as one of the variables fairly heavily influenced by hereditary factors. Disconnectedness may be symptomatic of subjective reflectiveness. See Autia, following.

5) Factor F (Surgency) is especially characterized by the combination of a wider right border, a small word distance span and a more extended lower zone. The prediction is enhanced by permitting the height of the upper zone letters to act as a suppressor. Surgency is a variable in extroversion, too. The writing of surgent individuals also tends to be faster, have greater paragraph indenture depth, smaller distances between words and a smaller number of total loops. Graphological rationale led the writer to expect greater writing speed and a more extended lower zone for surgent persons. The strongest single symptom of surgency in this data is a small word distance span.

6) Factor G (Super Ego) is especially characterized by connectedness, a large number of total loops and a large ratio of total height to middle zone height. In common with persons of strongly integrated will power (factor Q3) the top border tends to be wider, too. In this respect the two character traits are similar. The reader will probably notice that loopiness particularly characterizes the writer of high super ego, while it has no apparent relationship to Q3, will power. In psychoanalysis, the super ego is related to the respect that persons have for authority figures. Graphologists have pointed out that a very wide top border tends to indicate great respect by the writer for the addressee.

The strength of the loopiness variable as specifically measured here is a new way of looking at what may be the same thing basically as curvature of writing as opposed to jaggedness (or angularity) of writing. A strongly curved writing has been regarded as indicative of a complaisant, co-operative person. A dominant and aggressive writer (Factor E) has very few loops. Altogether, the simple easily accomplished counting of total loops, as well as the specific consideration of the degree of loopiness present in the lower, middle and upper zones may be of considerable potential in graphological analysis.

7) Factor H (Parmia) is especially characterized by an ascending writing line, by a smaller number of total loops and a greater degree of connectedness. Parmia is related to "steady nerves" and being able to keep cool in an emergency. Note later that the strong willed person (High Q<sub>3</sub>) also tends to have a rising writing line. Parmia is one of the basic elements in extroversion.

It is interesting to observe that the pattern of handwriting variable correlations with dominance and parmia are very similar. The major difference is that parmia is correlated with the inclination of the writing line but not dominance. The remaining correlations are the same in direction and even similar in size: degree of connectedness, small word distance open is related to dominance more than parmia, but the direction is the same and both are associated with relatively few total loops.

8) Factor I (Premia) is especially characterized by a larger middle zone height, a larger total height and a larger span of inclination and the prediction is enhanced by permitting the distance between the lines to act as a suppressor variable. Also the distance between the words is larger and the distance between the letters is wider for premia individuals.

9) Factor L (Protension) is especially characterized by a shorter middle zone and a larger span of inclination and the prediction is enhanced by permitting the height of the upper zone letters to act as a suppressor. For protension the distance between the lines tends to be smaller, there is a smaller ratio of the total height to the height of the middle zone and the ratio of the capital letter height to the upper zone letter height tends to be smaller, as well.

10) Factor M (Autia) is especially characterized by a wider distance between lines, fewer lower zone loops and a larger ratio of total height to middle zone height. The prediction is enhanced by permitting inclination to act as a suppressor. Autia is also important in the higher order extroversion factor, but is scored in the negative (introversion) direction. It is related to the stronger "inner life" of introverted persons. The writing of the autistic tends to be disconnected too, which has been noted by several graphologists. Autistic individuals can be reflective even to the point of absent-mindedness. Cattell reports that autistic persons account for statistically significant greater number of auto accidents than those who are more "wide awake".

11) Factor N (Shrewdness) is especially characterized by a smaller distance between words, higher upper zone letters and the prediction is enhanced by permitting the height of the lower zone to act as a suppressor. Shrewd writers tend to also have more connected writing, greater paragraph depth, higher capital letters and a higher middle zone as well as a greater total height. Graphological rationale has placed particular emphasis on a well developed middle zone in relation to shrewdness. Sometimes the middle zone is found to be so well developed that the writing appears to be "all middle zone" in extreme cases. In such cases there may be almost no extension either of upper or lower zones according to graphological theory.

12) Factor O (Guilt Proneness or Timidity) is related to the tendency to worry and self-blame. Clinically the writer had found in comparing Cattell Sixteen Personality Factor and Minnesota Multiphasic profiles that if an individual scores high on O he will tend to score high on psychasthenia as would be expected. Timidity may be predicted by combining the width of the left border with the span of inclination and permitting the width of the top border to act as a suppressor. In addition more timid individuals tend to have smaller middle zone heights and fewer lower zone loops while the ratio of the capital letters heights to the upper zone letter heights tends to be larger. Cattell points out that factor O tends to be particularly low for psychopaths, and other strongly extroverted persons who tend to "act out" conflicts. Graphologists have frequently pointed out the presence of a very narrow and even non-existent

left border in the case of such individuals. Likewise they have pointed out the wide left border in the case of the more timid or guilt prone.

13) Factor  $Q_1$  (Radicalism) is especially characterized by a wider right border, a greater distance between words and a larger number of upper zone loops. Radical writers also tend to have a narrower left border, a greater distance between lines and a smaller span of inclination of the writing line.

14) Factor  $Q_2$  (self-Sufficiency) is especially characterized by disconnectedness and a wider right border and the prediction is enhanced by the suppressive action of the width of the left border. The writing of self-sufficient individuals also tends to have a small span of inclination of the writing line. Self-sufficiency is another trait which plays a part in the second order factor of introversion. Self-sufficiency has been associated with the unwavering writing line before by graphologists, but in this data the trait is more strongly associated with disconnectedness and the width of the borders.

15) Factor  $Q_3$  (Integrated, Well Developed Will) is especially characterized by a greater connectedness, a smaller word distance span and a smaller total height and the prediction is enhanced by permitting the height of the capital letters to act as a suppressor. Strong willed, well integrated persons also tend to have wider top borders, smaller paragraph indenture depths, more narrow letters and an ascending writing line (as was indicated under Factor H, above). Graphologists have noted the

ascending writing line as having something to do with optimism and being able to remain efficient in emergencies. Generally speaking an integrated, strong willed person appears to have a well knit, regular writing with regular spacing and the writing tends to be smaller. This latter description of the writing of persons of "good character", has often been given by graphologists. There is comparatively little similarity in the handwriting patterns for the two character traits of super ego and will power, however. This is a factor which should receive more study by graphologists who generally do not distinguish between these character traits, but rather speak of strong or weak "character".

16) Factor Q4 (Ergic Tension) is especially characterized by smaller lower zone height, fewer lower zone loops and the prediction is enhanced by permitting the upper zone letter height act as a suppressor. Writers strong in ergic tension also tended to have deeper paragraph indentures and to have greater distance between the lines. Correlations of handwriting measurements with ergic tension were lowest for any of the personality traits measured. The writer suspects that pressure variables should be studied in relation to ergic tension.

The general purpose of this study has been to begin to draw together the streams of factor analytic personality study and some of the most objectively measurable of handwriting traits. The results suggest that it may be possible to substitute specific regression equations for

the intuitive interpretation of trait-context configurations in handwriting specimens; at least for the personality and handwriting variables here studied and for the population sampled. The multiple correlations still account statistically for only a fraction of the variance for most of the personality traits. However, these multiple correlations might rise if one could attain higher experimental criteria reliability. Theoretically they should. They offer an objective base upon which further data can be built for more accurate prediction. It was noted before that all handwriting variables have not been studied here by any means.

3. Some Unexpected Results of this Study from the Standpoint of Graphological Rationale and a Note on Paragraph Indenture Depth.

First it is well to point out that three of the handwriting variables do not appear in the multiple correlations at all: writing speed, paragraph depth and slant. Writing speed figured importantly in the system of Robert Soudak. Here it shows correlation with only two of the personality dimensions studied. It correlates  $-.20$  with Factor B, a power rather than a speed measure of general intelligence. This general low relationship of speed of writing to personality dimensions was one of the least expected results of the present study. It should be emphasized, however, that Soudak, in speaking of speed of writing was not referring primarily to simple, rather direct measurement, as reported here, but to a complex series of criteria for

estimating the speed of writing from the writing specimen itself<sup>41</sup>. The findings in this study may mean that Saudek's system of graphology would need revision. On the other hand there is the bare possibility that there is a behavioural dimension of speed, possibly a general factor, which is relatively independent of the personality factors studied. Guilford<sup>42</sup> is undecided about the existence of a general factor of speed. In relation to the domain of intellectual abilities, he is quite doubtful. But he does report four separate studies showing the existence of a finger speed factor. Extensive discussion of this matter would be out of place, but it is of some interest that writing speed is correlated negatively in this study with a power and not a speed measure of intelligence. That is to say, if a speed measure of general intelligence were used one might find a different relationship. Perhaps speed of writing has relatively little personality significance and more psycho-motor significance, although this would require confirmation by special study. The other

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41 In the opinion of the writer the over-all set of judgements about the speed of the writing in Saudek's system resembles the basic Formiveau of Klages' system. Perhaps the two are really the same. They serve as a basis for judging other variables in both systems.

42 J. P. Guilford, *Personality*, New York, McGraw-Hill, 1959, p.398 and p. 352-353.

correlation of speed of writing is with surgency (Factor F). This relationship is positive (.20) and in the logical direction if one reasons that writing as well as other functions are speeded up with euphoria or cheerfulness and slowed down by depression.

Since speed of writing played so important a role in the system of Saudek and since he was by general accord an unusually gifted and serious student of graphology, it is to be hoped that these findings relative to speed of writing will receive further study. Also, as before, the experimental attenuation in the criteria must be taken into account. Probably the real answer is that the "speed" measured here is quite different than Saudek's "speed".

Slant of writing also did not enter the multiple correlations reported. Slant has been integral to all major systems of graphology, and probably would come into consideration here if the handwriting inter-correlations were subjected to factor analysis, as might also the speed of writing. A number of graphologists have offered the hypothesis that slant represents the degree of subjugation of affection to intelligence, with a vertical handwriting representing a balance between the two, a backhand representing over-subjugation and a marked forehand, under-subjugation. Slant, (defined as running from backhand to forehand) is positively correlated with cyclothemia (.31) - personality warmth, and negatively correlated with general intelligence (-.25).

Paragraph indenture depth has never been discussed in graphology before to the knowledge of this writer. This study indicates that it is of some interest.

Paragraph depth correlates .25 with general intelligence, .20 with shrewdness, .20 with self-sentiment or will control, and .20 with ergic tension. It may partake of a spacing factor along with other spacing variables associated with general intelligence (and almost every measure of space not occupied by script is positively correlated with general intelligence). All of these correlations of paragraph depth with personality variables except with ergic tension are reduced considerably by attenuation. Hence this variable should be regarded as potentially interesting, possibly as a "confirmatory" variable to use in addition to those of the multiple-correlations, predicting one or more personality traits.

#### 4. Suggestions for Further Research.

An experimental design which would combine all possible variables, including those of pressure, with complete experimental naivete on the part of the subjects, has not yet become apparent to the present writer. The measurement of pressure variables has increased greatly in facility, accuracy and reliability through research at The Handwriting Institute, by Tripp, Fluckiger and Weinberg<sup>43</sup>, however, and a design meeting these ideals may be forthcoming in the future.

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<sup>43</sup> C. A. Tripp, F. A. Fluckiger, and G. H. Weinberg, "Measurement of Handwriting Variables", in Perceptual and Motor Skills, Monograph Supplement 5, Vol. 7, 1957, p. 279-294.

On the side of the measurement of personality variables, considerable progress continues to be reported by Scheier and Cattell<sup>44</sup>. The objective measurement of personality variables, however, requires much more time than measurement through questionnaires. Further, not entirely the same aspects of personality have so far emerged from the objective tests. It would be of considerable interest to study their expression, if any, in handwriting, as well.

Handwriting would appear to offer some advantages for personality prediction for, if results reported here can be confirmed and strengthened, testing time would be reduced materially - the "Context Based Association Test" takes only ten minutes or so and can be group administered, as well. With tables, and appropriate instruments available, measurements and predictions might be materially reduced in time. Further, clinical research suggests that handwriting may be more pregnant with information than this study shows. Clearly much more research must take place before graphology will have a completely adequate experimental foundation, however. The factorial structure of handwriting measurements will need continued study in itself. An important step in this direction has been taken by Lorr, Lepine and Golder<sup>45</sup>, who factored

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<sup>44</sup> I. H. Scheier and R. B. Cattell, "Confirmation of Objective Test Factors and Assessment of their Relation to Questionnaire Factors: A Factor Analysis of 113 Rating, Questionnaire and Objective Test Measurements of Personality", in the Journal of Mental Science, Vol. 104, No. 436, 1958, p. 608-624.

<sup>45</sup> Maurice Lorr, L. T. Lepine and Jacob V. Golder, "A Factor Analysis of Some Handwriting Characteristics", in Journal of Personality, 1954, Vol. 22, p. 348-353.

a matrix of variables defined operationally by reference to the Lewinson and Zubin scales, also used as a primary reference for the measurements made here. No factor analysis of handwriting traits was undertaken in the present study, but reference to Table II and the related discussion at the end of Chapter III will indicate to the reader that several factors could probably be extracted. The close inter-relationship of handwriting variables was further emphasized by the excellent studies of Pascal, who concerned himself with the Lewinson and Zubin variables<sup>46</sup> and additional pressure variables<sup>47</sup>. Pascal reported equally strong relationships between the pressure and non-pressure variables just mentioned. Clearly the most meaningful factor analysis would be across the whole domain of handwriting variables.

In searching for alternative statistical techniques to those used in this study which might be applicable to phases of the general problem of validating graphology the writer found himself much interested in the manifest structure analysis developed by du Mas<sup>48</sup>. Manifest structure analysis is a technique which permits the construction of what he calls catascales. These are scales

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46 G. R. Pascal, "The Analysis of Handwriting: A Test of Significance", in Character and Personality, 1943, Vol. 12, p. 123-144.

47 -----, "Handwriting Pressure: Its Measurement and Significance", in Character and Personality, Vol. 11, 1943, p. 234-254.

48 Frank M. du Mas, Manifest Structure Analysis, Missoula, Montana, Montana State University Press, 1955, p. ix-193.

which are built up from qualitative data or any data even quantitative which can be reliably categorized. This approach seemed attractive because it would appear to offer a way to draw together the large number of signs and assess their over-all capacity to predict specific personality criteria. Quantitative variables such as those studied here could then be categorized into three parts, low, medium and high, according to du Mas<sup>49</sup> and treated as categories along with the qualitative data. In this way, an over-all manifest structure analysis might bring together the qualitative and quantitative of graphology into one coherent whole. This ideal was considered as an approach for the data collected in this study, but it was decided that the level of experimental criteria reliabilities actually reached for most of the variables would not support such an analysis. Most of the data here would support only the analysis undertaken, in the view of the writer.

If the approach chosen by the present writer for a further validation study were to be undertaken the researcher is cautioned to take all measurements as close to each other as possible, in a single sitting of the subjects if this can be managed. All three forms of the Cattell Questionnaire should be used in order to gain the maximum possible experimental reliability and factor saturation. This writer went to considerable effort to maintain subject experimental naivete, as the reader is aware. How this can be maintained in the study of pressure

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49 Frank M. du Mas, Private Communication, October 18, 1960.

variables is not readily apparent. Perhaps it is not absolutely necessary. To work out a design which would permit the study of pressure variables as well as variables such as those studied here and qualitative variables is a worthy object of design ingenuity. Such a design would "capture" data which should be very decisive. A series of smaller studies is, of course, possible. Any of the hypotheses set forth in this chapter could be individually tested and possibly amplified by the inclusion of more handwriting variables. The wholistic approach seems desirable, however, because of the fact so clearly indicated in this study that no one handwriting trait is related to but a single personality trait and no personality trait to but a single handwriting trait. This appears to be the kind of a problem which though difficult to attack as a whole nevertheless should be so attacked.

## SUMMARY AND CONCLUSIONS

1. The Cattell Sixteen Personality Factor Questionnaire was administered to 110 male, right handed college students enrolled in a course in introductory psychology. Since the sample was exhausted, it constituted a random sample of this population. To obtain handwriting samples, the subjects also took a pseudo-association test in which they were required, under carefully controlled conditions to copy a passage. No subject was aware that his handwriting would be subject to analysis.
2. Twenty-two basic handwriting measurements and three measures derived from them were made. Remeasurement reliability for these averaged well above  $r = .90$ .
3. Tetrachoric correlations were run between all pairs of handwriting and personality measures. Regression was observed to be linear for all variables, but no statistical tests for linearity were made.
4. Intercorrelations between handwriting variables varied considerably in size and direction.
5. Correlations between handwriting and personality variables were found to be materially reduced by experimental attenuation in the personality criteria, but suggested by their pattern that unique multiple regression equations for the prediction of the personality variables might be developed.

6. Multiple correlations were then calculated for each of the sixteen personality criteria studied. These ran from a low of .305 to a high of .626. They were calculated from tetrachoric correlations. An appropriate standard error formula is lacking for multiple correlations calculated from tetrachorics.
7. The multiple correlations were expressed in the form of sixteen hypotheses. These hypotheses are as follows:
  - a. Cyclothymia is characterized by the combination of a wider left border, greater distance between letters and larger capital letters.
  - b. General Intelligence is characterized by a wider right border, a wider distance between the lines, a greater word distance span and a smaller ratio of capital letter height to upper zone letter height.
  - c. Ego Strength is characterized by connectedness, wide letters and the distance between letters serves as a suppressor.
  - d. Dominance is characterized by small word distance span, connectedness and fewer total loops.

- e. Surgency is characterized by a wider right border, a small word distance span, a more extended lower zone and the height of the upper zone letters acts as a suppressor.
- f. Super Ego is characterized by connectedness, a large number of total loops and a large ratio of total height to mid-zone height.
- g. Farnia is characterized by an ascending writing line, by a smaller number of total loops and a greater degree of connectedness.
- h. Premia is characterized by a larger middle zone height, a larger total height, a larger span of inclination and the distance between the lines acts as a suppressor.
- i. Protension is characterized by a shorter middle zone and a larger span of inclination while the height of the upper zone letters acts as a suppressor.
- j. Autia is characterized by a wider distance between lines, fewer lower zone loops, a larger ratio of total height to middle zone height and inclination serves as a suppressor.
- k. Shrewdness is characterized by a smaller distance between words, higher upper zone letters and the height of the lower zone acts as a suppressor.

- l. Guilt Proneness is characterized by a wider left border, a larger span of inclination of the writing line and the width of the top border acts as a suppressor.
  - m. Radicalism is especially characterized by a wider right border, a greater distance between words and a larger number of upper zone loops.
  - n. Self-Sufficiency is characterized by disconnectedness, a wider right border and the width of the left border serves as a suppressor.
  - o. High Self Sentiment Formation is characterized by connectedness, small word distance span, small total height and the height of the capital letters acts as a suppressor.
  - p. Ergic Tension is characterized by smaller lower zone height, fewer lower zone loops, while the upper zone letter height acts as a suppressor.
10. The thesis that combinations of handwriting variables by intuition can be replaced by objective linear regression equations for the prediction of personality traits was partially confirmed. But the multiple regression equations found need to be complemented by other objective handwriting traits than those studied.

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## APPENDIX

### ABSTRACT OF

#### A Continuation of the Search for Objective Graphological Hypotheses<sup>1</sup>

This study explored relationships between handwriting and personality factors. The sums of the factor scores for Forms A and B of the Cattell Sixteen Factor Personality Questionnaire served as the experimental criteria for 110 male, right handed college students. Five weeks intervened between the administration of the forms of the Cattell test during which controlled samples of the subjects' handwriting were obtained. The subjects were unaware that their handwriting would be measured and analysed. The stability coefficients of the personality factor scores over the five week interval were calculated and were taken as the best estimate for experimental criteria reliabilities. These values ranged from .21 to .79. Twenty-five handwriting traits were measured with remeasurement reliabilities ranging from .83 to 1.00. Tetrachoric correlations were run between all pairs of handwriting and personality traits and between all pairs of handwriting traits. These two sets of correlations were explored by multiple correlations. Sixteen multiple Correlations resulted. These revealed

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<sup>1</sup> Ph. D. Thesis presented by Wilburn R. Mann, in 1961, to the School of Psychology and Education of the University of Ottawa, p. 92.

which handwriting traits in combination were most predictive of the experimental personality criteria and also revealed several suppressor variables among the handwriting traits which aid in these predictions. The multiple correlations ran from .305 to .626.

The multiple correlations were expressed in the form of objective hypotheses which can be tested and elaborated singly or together in further research. Because of low experimental criteria reliabilities the first order correlations between the handwriting and personality traits were reduced in size. Theoretically, under conditions of increased personality criteria reliabilities, these would increase. The study was regarded as having chiefly exploratory value in that unique patterns of handwriting traits predictive of the sixteen personality factors studied emerged, but continued study is required to confirm and possibly further elaborate them.